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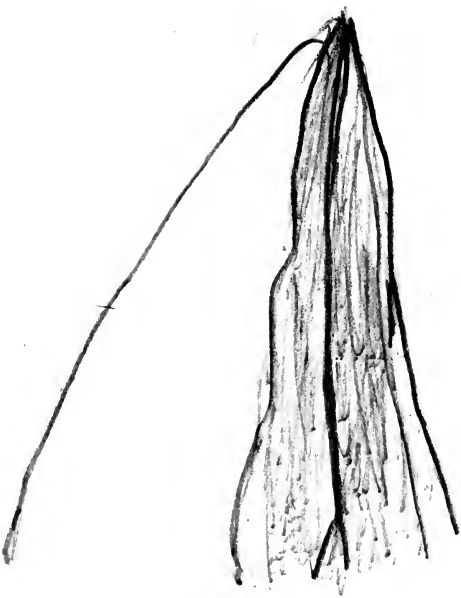

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PREFACE TO THE FIRST EDITION.

PREFACE

The success which attended the author's first series of Catechisms has encouraged her to attempt a second one, not quite so infantine in its style and character, but entering more fully into the subjects treated of.

She is aware that the works of this description already in circulation are by no means few; but, with some exceptions, they will be found either not simple enough for the junior forms, or else so diffuse that their price renders them unavailable for the use of more advanced pupils. The want of due classification is also another objection frequently raised against such books—a defect which, in the present one, has been remedied by referring, whenever practicable, each particular to its appropriate head, and by omitting whatever is irrelevant or extraneous.

In a book so limited as this one is, both as regards extent and cost, it has, of course, been impossible to enlarge upon many of the sciences, such as Geology, Chemistry, Mechanics, &c.; while others, Geography, Astronomy, &c., for instance, have been wholly omitted, as forming studies of themselves. It is, however, hoped that sufficient explanations have been given on

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every subject discussed, not only to present a general view of its nature, but also to render intelligible to children such of the terms connected with it as are of almost daily occurrence.

PREFACE TO THE THIRD EDITION.

In this new edition of the "First Principles of General Knowledge," the style has been amended throughout, faulty definitions have been corrected, and additional matter introduced where required. For the purpose also of enlarging the pupil's acquaintance with several of the subjects which, for obvious reasons, have been treated of more briefly than their importance demanded, reference has, at the suggestion of several experienced teachers, been made to Mr. Quested's improved edition of "Erredge's Student's Hand-Book of General Knowledge," a work comprising much curious and valuable instruction. Mrs. O'Brien's "Simple Catechism of the Animal, Vegetable, and Mineral Kingdoms," may also be consulted with great advantage, and would moreover prove an interesting and useful *vade-mecum* of a visit to the South Kensington Museum.

JOHN DAVENPORT

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CHAPTER I.

CHRONOLOGY.

Q. From what is the word Chronology derived?

A. From two Greek words, *Chronos*, Time, and *logos*, a discourse.

Q. How has time been divided?

A. Into eras, or epochs, or certain periods at which great events have happened, and from which time is reckoned.

Q. Which are the most important of these eras?

A. The creation of the world, from which the Jews reckon, called—the Jewish era; and the birth of Christ, from which the Christians reckon, called—the Christian era.

Q. What were the principal eras among other nations?

A. The Romans reckoned from the building of their city, and the Greeks by Olympiads.

Q. Are not certain letters used to represent these eras ?

A. Yes ; A.M. *anno mundi*, in the year of the world, for the Jewish era. It is 5863 years since the creation of the world ; we are therefore in the year A.M. 5863.

Q. What letters are used for the Christian era ?

A. A.D. *anno Domini,* in the year of our Lord. It is 1860 years since Christ was born; we are now, therefore, in the year A.D. 1860.

Q. What letters were used by the Romans ?

A. A.U.C. *ab urbe condita*, from the building of the city. The present year would be A.U.C. 2612, as Rome was built 753 years before Christ.

Q. What was an Olympiad among the Greeks ?

A. A space of five years; and it was during the fifth that the Olympic Games were celebrated.

Q. What were the Olympic Games?

A. Festivals in honour of Jupiter. The first Olympiad commences 776

years before Christ was born, which event happened in the 155th Olympiad.

Q. Have not the Mahometans a particular era?

A. Yes; they reckon from the *Hegira*, or flight of Mahomet, which happened 622 years after Christ. The Mahometans believe that Christ was a prophet, but that Mahomet was a greater one than he.

Q. Have other nations particular eras, from which they date their time?

A. None of any importance, as most civilized nations reckon from one of these, except the Chinese, who date from the deluge, affirming that they are the real descendants of Noah, who was no other than their king Foi.

Q. What people first divided time into years?

A. The Egyptians; at first a year consisted of only one month, then of four, and lastly of twelve, forming a lunar year of 360 days.

Q. What information does the knowledge of this afford us?

A. It accounts for the vast anti-

quity attributed to the world, and explains how some of their kings may be said to have lived a thousand years.

Q. What other contemporaneous nation adopted the Egyptian year?

A. The Greeks: Cecrops, the Egyptian, founded Athens about the time of Abraham.

Q. What is supposed to have first occasioned the division of time into years?

A. The changes of the moon; as it revolves round the earth in twenty-nine days and a half: which interval of time, now called a month, formed the first Egyptian year.

Q. What occasioned the extension to twelve months?

A. The discovery that the different seasons came round again in the space of about 360 days; but, although the Chaldeans were the earliest astronomers, and Egypt has been called the cradle of the sciences, many years elapsed before the real cause of the changes of the seasons was discovered.

Q. By whom was the length of the solar year first fixed?

A. By Thales, a Grecian philosopher, one of the seven wise men of Greece; he added five days to the year, making it to consist of 365 days.

Q. Why was this called a solar year?

A. Because it was supposed to be the time the sun took to go round the earth; for the ancient astronomers believed the earth to be stationary, and that the sun with the planets moved round it.

Q. When did Thales live?

A. In the fourth year of the forty-eighth Olympiad, 625 years before Christ.

Q. Did this number of days in the year make it agree with the solar year?

A. No; because the earth goes round the sun in 365 days five hours and a fraction; so that, when the next change took place, it was found that the year was many days in arrear of the sun, as every four years the six hours amounted to another day.

Q. Did the Romans adopt the division of the year used by the Greeks?

A. Not at first; Romulus, the founder of Rome, divided the year into ten months, imagining the sun performed his annual course in that time.

Q. What alteration did Numa make?

A. He added two months more, making the year to consist of 355 days; but he afterwards, in imitation of the Greeks, added months and days, until, at the time of Julius Cæsar, there had been sixty-five days added.

Q. By whom was the next change made?

A. It was made by Sosigenes the Egyptian astronomer, who lived in the time of Julius Cæsar, the Dictator.

Q. What name was given to the year in which the alteration was so made by Sosigenes?

A. *The year of confusion;* there were fifteen months in it.

Q. In what way did Julius Cæsar compensate for the six hours?

A. He decreed that every fourth

year should consist of 366 days, and have the name of Bissextile or leap-year. This is called the Julian year, and it first began to be computed in the year of Rome 708, about forty-three years before Christ.

Q. What is meant by bissextile?

A. The word bissextile is derived from *bis,* twice, and *sextus*, sixth; because in leap-year the 24th of February comes twice over; in other words, there are two 24ths of February.

Q. Why was the 24th of February called the sixth?

A. Because one of the divisions of time among the Romans was into calends, and the 24th of February was the sixth of the calends. From this word calends, came that of calendar, signifying the different divisions of time among the Romans.

Q. Did any thing after this occur to require change?

A. Yes; it was found that, by adding a day every four years, the Julian year would, in 1600 years, be eleven days in advance of the sun.

Q. What was the cause of this?

A. The earth takes 365 days, 5 hours, 48 minutes, 57 seconds, and 39 thirds, to go round the sun, thus forming a solar or astronomical year, consequently it was eleven minutes less than six hours every year; this error of eleven minutes had, in the course of time, caused that of eleven days in the calendar.

Q. Among what nations was the Roman Calendar then in use?

A. Among most civilized ones.

Q. Who detected the above error?

A. Pope Gregory; and he was enabled to do so by finding that the sun entered Aries on the 10th of March instead of on the 21st, at the vernal or spring equinox; at which time the astronomical year begins.

Q. How did he correct it.

A. By throwing out eleven days; so that the fourth of October was reckoned as the fifteenth, and so on. It was in October, 1512, that the New Style, as it is called, commenced on the continent, but it was not adopted in England till the year 1752.

Q. What changes would have arisen if the error in the calendar had not been detected?

A. The seasons would have changed their time of appearing: we should have had Midsummer in May, and Christmas-day in November.

Q. What were the means adopted by Pope Gregory to prevent this error from occurring in future?

A. He ordered that leap-year should be omitted at the expiration of a hundred years, if the date of the year would not divide evenly by four; thus 1600 was a leap-year, but 1700, 1800, were not.

Q. Cannot leap-year be found by dividing the date of the year by four?

A. Yes; 1850 was not a leap-year, because when divided by four there is a remainder; but 1852 leaves no remainder, and therefore was a leap-year.—$^{4})\frac{1850}{462}-_{2}$ $^{4})\frac{1852}{463}$.

Q. What is a lunar year?

A. It consists of twelve lunar months; during which time the moon revolves twelve times round the earth.

A lunar month is about twenty-nine days and a half.

Q. What is a calendar month ?

A. The twelfth part of a year ; some of the calendar months consist of thirty and others of thirty-one days ; February has twenty-eight, excepting in leap-year, when it has twenty-nine.

Q. Is the division of years into months very ancient ?

A. Yes ; the earliest account is in the Bible, and occurs in the passages where mention is made of the time that Noah remained in the ark, as also in those where the wanderings of the Israelites through the wilderness are spoken of.

Q. What were the names of the Jewish months ?

A. Nisan, or Abib, answering to part of our September and October, as the Jewish year began at the first full moon after the 21st of September—

Jair, or Zius—answering to our November.
Siban, or Siwan, ...December.
Thamuz, or Tamuz, ...January.
Ab, ...February.
Elul,.....March.

Tisri, or Ethanim—answering to our April.
Marchesvan, or Bul, ...May.
Cisleu, ...June.
Tibeth,.....July.
Sabat, ...August.
Adar, ...September.

Q. Had not other nations names for their months?

A. Yes; but the Roman names are the only ones of importance, as from them those of the English months are derived; all of them being, moreover, significative, thus:—Januarius—(January) was so called from Janus, the god of the year, who is represented with two faces, one looking forward, the other backward.

January—being the first month, was supposed to be the time in which persons looked forward to the new year and back upon the old one.

Februarius—February, from a feast called Februa, held by the Romans in that month.

Martius—March, because this being the first month formed by Romulus, he gave it the name of his supposed father the god Mars.

Aprilis—April is derived from the Latin *Aperio*, I open, because the earth then opens her bosom for the production of fruits and vegetables.

Maius—May, from the goddess Maia, the mother of Mercury, whom the Romans worshipped on the first of May.

Junius—from the goddess Juno, the wife of Jupiter, and queen of heaven.

The remainder of the months took their names from their numerical order, reckoning from March, which Romulus made the first month.

Quintilis, the fifth	July.
Sextilis, the sixth	August.
September, the seventh	September.
October, the eighth	October.
November, the ninth	November.
December, the tenth	December.

Q. Were the fifth and sixth months always called Quintilis and Sextilis?

A. No; Julius Cæsar having been born in the month Quintilis, it was named Julius in honour of him. Sextilis was changed into Augustus in honour of Augustus Cæsar, whose birthday was in that month. From these names come our July and August.

Q. What is supposed to have occasioned the division of time into weeks?

A. The four changes of the moon during her revolution round the earth, each of which takes rather more than seven days; it had been used from the earliest time by the Syrians, Egyptians, and most eastern nations, but was not introduced into Europe until the establishment of Christianity.

Q. How was the month divided by the ancient Greeks and Romans?

A. By the Romans into periods of nine days, and by the Greeks into those of ten days, hence called—decades; but some ancient writers assert that the seventh day was honoured by these and other nations.

Q. Where do we read the earliest account of a week?

A. In the Bible; where it is stated that God created the world and all it contained in six days, and rested on the seventh day and blessed it.

Q. Is it not most likely that this ordination of God was the real origin of the division of time into weeks?

A. Yes; as all nations are descended from Noah, and as the Israelites, the chosen people of God, were, for four hundred years, captives among the Egyptians.

Q. Had the Jews names for the days of the week?

A. No; the Sabbath was the seventh day—the next day was called the first of the Sabbath, the following the second, and so on, except the sixth, which was called the preparation for the Sabbath.

Q. What names were given by the ancient heathens to the days of the week?

A. The names of the seven heavenly bodies then known, thus:—

Dies Solis	Sun-day.
Dies Lunæ	Moon-day.
Dies Martii	Mars-day.
Dies Mercurii	Mercury's-day.
Dies Jovis	Jupiter's-day.
Dies Veneris	Venus-day.
Dies Saturni	Saturn's-day.

Q. Are not the French names of the days of the week derived from these?

A. Yes; thus:

Dies Lunæ	Lundi.
Dies Martii	Mardi.
Dies Mercurii	Mercredi.
Dies Jovis	Jeudi.
Dies Veneris	Vendredi.
Dies Saturni	Samedi.

Q. From what are our English names derived?

A. From the names of the gods and goddesses, whom the Saxons worshipped on particular days of the week: thus they worshipped the sun on Sunday, the moon on Monday, Tuesco on Tuesday, Woden on Wednesday, Thor on Thursday, Friga on Friday, and Sater on Saturday.

Q. Who was the greatest of these gods?

A. Woden, whom they worshipped on Wednesday. Friga was the wife of Woden, and Mother of Thor, who was next to his father in greatness.

Q. How many weeks are there in a year?

A. Fifty-two weeks and one day; in leap-year there are fifty-two weeks and two days.

Q. How did the ancient Romans divide their months?

A. Into calends, ides, and nones. The calends were the first day of every month, the nones the seventh, and the ides the fifteenth days of March, May, July, and October; in every other month the nones were on the fifth, and the ides on the thirteenth.

Q. How were the days reckoned?

A. They were counted backwards; the sixth of March, instead of being the sixth of the calends, was the first, or one day before the nones; and the eighth of May, instead of being called the second of the nones, was the sixth before the ides.

Q. What is generally understood by the terms artificial and natural day?

A. The artificial day is the time between sunrise and sunset, and varies with the latitude of places. The natural or astronomical day is reckoned from noon to noon, and consists of the same length of twenty-four hours in all latitudes.

Q. Do all nations begin their day at the same time ?

A. No ; the Babylonians, Persians, Syrians, modern Greeks, and other Eastern nations begin their day at sunrise.

Q. What nations begin their day at sunset ?

A. The Jews, Athenians, Italians, Austrians, Bohemians, and Chinese.

Q. When do the Arabians commence their day ?

A. At noon ; and the Egyptians and Romans, with the modern English, French, Dutch, Germans, Spaniards, and Portuguese, at midnight.

Q. How is the artificial day divided?

A. The Greeks divided the time of light into twelve equal parts ; this they learnt from the ancient Egyptians ; the Jews did the same ; consequently each of these twelve parts, or hours, must be longer in summer than in winter. They are called unequal hours.

Q. When was the division of the day and night into twenty-four hours known to the Romans ?

A. Not till after the first Punic war; the Romans did not then as now begin their day at midnight, but assigned twelve hours to the day and twelve to the night.

Q. When did their day begin?

A. At six in the morning; the hours of the day being reckoned therefrom—nine o'clock in the morning was called the third hour of the day; twelve o'clock the sixth, three o'clock the ninth, and so on.

Q. How were the twelve hours of the night divided?

A. Into four watches of three hours each; the first ended at nine o'clock, the second at twelve, the third at three, and the fourth at six, when day commenced.

Q. Will this information enable us to explain any passages in the New Testament?

A. Yes, two: 1st, the one in which it is stated that when our Saviour was crucified, there was darkness over the earth from the sixth to the ninth hour; this was, consequently, from midday to

three o'clock in the afternoon. 2nd, the other, in which it is said, "And in the fourth watch of the night, Jesus went unto them (his disciples), walking on the sea;" this, therefore, must have been between three and six o'clock in the morning.

Q. Why should this division of time among the Romans apply to the time of our Saviour?

A. Because Judea was then a Roman province, and many of the Roman laws and customs had become common among the Jews.

Q. Have not some particular days in the year been observed by all nations?

A. Yes; either in honour of their religion, their laws, or their great men —days in honour of religion are generally either feast-days or fast-days.

Q. What were the principal feasts among the Jews?

A. The Sabbath, the feast of Weeks, the feast of Pentecost, and the feast of the Passover. Some of our fasts and festivals occur at the time of these Jewish ones.

Q. Is the Christian Sabbath the same day as the Jewish ?

A. No; the Jewish Sabbath is the seventh day of the week, being the day on which God rested, after the six days of creation. Our Christian Sabbath is on the first day of the week, being the day on which Christ rose from the dead.

Q. What Christian festival occurs at the time of the Jewish Passover ?

A. The festival of Easter, on which day Christ rose from the dead. It is the third day after Good Friday, on which day we commemorate his crucifixion, which took place the day before the Jewish Passover.

Q. Does Easter Sunday always take place on the same day of the year ?

A. No ; it depends upon the moon, Easter being the first Sunday that follows the first full moon after the 21st of March.

Q. Do not many of the other fasts and festivals depend upon Easter ?

A. Yes ; and they are therefore called movable feasts. Ash-Wednesday, the first day of Lent, must be forty

days before Easter; Palm-Sunday, a week before; Whit-Sunday, seven weeks, and Trinity-Sunday eight weeks after.

Q. When was this arrangement for Easter made?

A. In the year A.D. 325, by the Council held at Nice, a town in Germany.

Q. Why is the first day of Lent called Ash-Wednesday?

A. Because the early Christians used to put ashes on their heads, as a token of humility.

Q. When does Lent occur?

A. It is the interval between Ash-Wednesday and Easter.

Q. Why did the Council of Nice order Easter to be held at this time?

A. To avoid holding it on the same day as that of the Jewish Passover, which was always held on the day of the full moon.

Q. How did it happen that the two feasts occurred together?

A. Because our Saviour was crucified at the time of the Jewish Passover.

The Greeks and Latins called it Pascha, originally a Hebrew word signifying to pass over.

Q. What was the origin of the Passover ?

A. It was ordained by God, in commemoration of the destroying angel passing over the dwellings of the Israelites, when he put to death all the first-born of the Egyptians, among whom they dwelt.

Q. From whence came the name Easter ?

A. The ancient Britons had a Saxon goddess of the name of Eostre, whom they worshipped in April, and the Christian festival of Easter generally occurs in that month.

Q. When is Palm-Sunday ?

A. The Sunday before Easter. it is in commemoration of Christ's entry into Jerusalem, when the people strewed the way with palm branches.

Q. When does Whit-Sunday occur ?

A. It is the seventh Sunday after Easter; it was originally called White-

Sunday, because those who were newly baptized wore white garments.

Q. What Jewish feast occurs at this time?

A. The feast of Pentecost, when the Jews, from different parts of Judea, were required to assemble at Jerusalem.

Q. On what account do we keep this day?

A. In commemoration of the Holy Spirit having been poured out on the Apostles on this day, while they were at Jerusalem.

Q. What is Holy-Thursday?

A. The day on which our Saviour ascended to heaven: it is called Ascension-day, and is held ten days before Whit-Sunday.

Q. When is Trinity-Sunday?

A. It is the first Sunday after Whit-Sunday; and is the last of the movable feasts.

Q. Mention some feasts which always occur at certain days.

A. Lady-day, Midsummer-day, Michaelmas-day, and Christmas-day; also many days kept in honour of the saints.

Q. What are these days intended to commemorate?

A. Lady-day was originally called Our Lady's Day, because on that day the angel Gabriel announced to the Virgin Mary that she should be the mother of Jesus Christ. It is called Annunciation-day, and occurs on the 25th of March.

Q. When is Midsummer-day?

A. On the 24th of June: it is the festival in honour of St. John the Baptist. Michaelmas-day is on the 29th of September, and is in honour of St. Michael. Christmas-day is the commemoration of the birth of Christ, and is on the 25th of December.

Q. What is Twelfth-day?

A. Old Christmas-day, or the twelfth day after Christmas. When Pope Gregory threw out eleven days in order to rectify the Calendar, people were unwilling to forget the day on which Christmas had been kept; they therefore observed both, and the practice has been continued ever since.

Q. Is there not another feast on Twelfth-day?

A. Yes; the feast of the Epiphany.

Q. Of what other use are these days?

A. They are called quarter-days, and divide the year into four parts. On these days, matters of business, rent, and other affairs, are generally settled.

Q. How can Easter-Sunday be found for any year?

A. By finding the cycle of the sun, or of the Sunday letter; the cycle of the moon, the epact, the golden number, the dominical letter, and the Easter limit.

Q. What is the cycle of the sun?

A. It is a period of twenty-eight years, at the end of which time the days of the week, Easter, and other feast-days return to the same days of the month.

Q. What is a cycle of the moon?

A. A period of nineteen years, at the end of which time the new and full moons fall on the same days of the month.

Q. How is the cycle of the sun found?

A. By adding 9 to the given year, and dividing by 28, the remainder will be the sun's cycle.

Q. Why is 9 added to the year?

A. Because the first cycle was commenced nine years before Christ.

Q. How do you find the cycle of the moon?

A. By subtracting 1500 from the given year; because the first cycle is reckoned from the year 1500. Then divide by 19, and the quotient is the number of cycles that have elapsed since 1500: the remainder is the golden number.

Q. What is the golden number?

A. The number of years since the completion of the last cycle of the moon. The golden number for the year 1860 is thus found:—

1860
Subtract 1500
Divide by 19) 360 (18 number of cycles.
19
170
152
18 golden number.

Q. Why is it called the golden number?

A. Because when Meton, the Athenian, discovered it, the people were so pleased that they had it written in letters of gold, and hung up in the market-place.

Q. What is the epact?

A. The difference between a solar and a lunar year. A lunar year of 12 months contains only 354 days, and a solar year 365; there is therefore a difference of 11 days in the first year of the moon's cycle, 22 in the second, and so on.

Q. What is done with the number of these days when they get above 30?

A. They are divided by 30; the remainder will be the epact.

Q. What is the dominical letter?

A. One of the first seven letters of the alphabet, which are used for the seven days in the week: as the first of January and the last of December fall on the same day of the week, the letter for Sunday changes every year.

Q. How is the dominical letter found?

A. First divide the given year by 4, add the quotient to the year itself, and increase the amount by 6. This sum must be then divided by 7, and what is over subtracted from 7; the remainder is the number of the dominical letter.

Q. How are the letters numbered?

A. As follows:—

A	1
B	2
C	3
D	4
E	5
F	6
G	7

Q. What is the Easter limit?

A. The number of days from the first of March to Easter-day, both included. By the Easter limit, the epact, the golden number, and dominical letter, Easter-day can be found for any year.

Q. Find on what day of the year 1860 Easter-day will fall.

A. First find the golden number thus, as in page 26:—

1860
1500

19) 360 (18
19

170
152

18 golden number.

To find the epact, subtract 1 from the golden number, and multiply by 11; if the total be above 30, divide by 30: the remainder is the epact.

Golden number 18
1

17
11

30) 187
6 — 7 epact.

The Easter limit is then found by adding 6 to the epact, and subtracting the sum from 50: the remainder is the Paschal full moon, or Easter limit. Thus:—

Epact 7
6

13

50
13

37 Easter limit.

Then, for the dominical letter, divide 1860 by 4, thus, as described in p. 28 :—

4) 1860
465
6

7) 2331

333—0

0 subtracted from 7 leaves 7, which is the number of the dominical letter. The dominical letter for the year 1860 will be G.

To find Easter-day, 4 must be added to the number of the dominical letter, and the sum subtracted from the limit.

Dom. letter 0	Easter limit 37
4	4
4	33 remainder.

The remainder, 33, must be subtracted from the next highest number which will divide even by 7: this number must be 35.

35
33

2

The remainder, 2, must be added to the Easter limit, and the whole to the 1st of March. If the 31 days in March are then subtracted from it, the day in April on which Easter-day falls will be found.

Easter limit	37
	2
	39
31 days in March	31
	8th day of April.

Easter Sunday will therefore fall on the 8th of April, in the year 1860.

Q. Is not 1860 leap-year?

A. Yes; there will therefore be two Sunday letters; one used until the 29th of February, and one after.

Q. What letter is used before the 29th of February?

A. The letter following the dominical letter of the year; thus, the Sunday letter for 1860 is A G, and therefore, till after the 29th of February, D will be used.

Q. Are there not tables in prayer-books, and other books, by which Easter-Sunday may be found?

A. Yes; but as it is at once satisfactory and amusing to solve such questions ourselves, the above rules have been given to enable the pupil to work them.

CHAPTER II.

COINS, WEIGHTS, AND MEASURES.

Section. 1—*Money and Coins.*

ENGLISH AND FOREIGN.

Q. What is money?

A. Money is any thing which we exchange for food, clothes, or other articles we may wish to possess; but it is generally understood, among European nations, to be stamped coins.

Q. What is barter?

A. Barter is the exchanging one thing for another of the same value: it is only used now by uncivilized nations, who will give the produce of their country to strangers, in exchange for beads, nails, steel articles, &c.

Q. Was barter practised among the ancients?

A. Yes; Homer describes the golden armour of Glaucus to have been worth one hundred oxen, and that of Diomedes ten.

Q. To whom do the Greeks ascribe the invention of money?

A. To the wife of Midas, king of Phrygia, who is said to have had the power given him by Bacchus, of turning every thing he touched into gold.

Q. What is the earliest account we have of the use of money?

A. That in the Bible, where it is said Abraham gave four hundred shekels of silver for a burial-place for his wife Sarah. Josephus, who wrote a history of the Jews, ascribes the invention to Cain.

Q. To whom is it ascribed by the Romans?

A. To Janus, an old Italian deity. The Romans called money *pecunia*, the Latin name for money, either because their chief wealth was cattle, or because, as Pliny (the elder) says, their first coin was stamped with a cow; *vecus* being the Latin word for cattle.

Q. What are the metals most used for coin ?

A. Gold, silver, and copper ; but, in the earlier ages, iron rings, leather, and even wood, served for money. Copper was first used, then silver, and lastly gold.

Q. When was the first silver money coined in Rome ?

A. In the year of Rome 484 B.C. Gold was not coined till 100 years after.

Q. Was money always in round pieces, as it is now ?

A. No ; and even now in Spain it is multi-angular, and in some parts of India, globular.

Q. What is usually stamped on money ?

A. The head of the king of the country where it is struck. In ancient times, different nations stamped various effigies on their money. The Jews had the golden pot of manna on one side of their shekel, and Aaron's rod on the other.

Q. When were representations of

the heads of great men first stamped on coins, in Rome?

A. Not till after the fall of the commonwealth. Many nations had the figure of a horse, an owl, or an ox; but in modern times all nations have the head of their king, or prince, stamped on their coins, except the Mahometans, who, objecting to images, inscribe the name *only* of their prince.

Q. From whom did the Britons learn to coin money?

A. From their conquerors, the Romans. The earliest English coin was made in the reign of Ethelbert, first Christian king in Britain; money then began to be reckoned in pounds, shillings, and pence.

Q. From what was the term penny supposed to be derived?

A. From the word *pecunia*, money, or from *pondus*, weight, on account of the penny then weighing as much as three of ours. Five of these pennies made a scilling.

Q. What is supposed to be the origin of the word scilling?

A. Most likely from the scilingus, or the fourth part of an ounce.

Q. What is the origin of the word sterling, applied to money?

A. In the time of Richard the First, money coined in the eastern parts of Germany became very valuable, on account of its purity. The people were called Easterlings, and were sent for to England to improve the English coinage: the money thus coined was at first called Easterling, and now sterling.

Q. From whence arose the words farthing and halfpenny?

A. The Norman kings had a penny coined with a very deep cross on it, so that it could be broken into halves, called halfpennies, or fourth parts, called fourthings, from whence our word farthing is derived.

Q. When was gold first coined in England?

A. In the year 1320, in the reign of Edward the Third. Most of the countries of Europe began to coin money about this time. The first pieces were

called Florentines, as they were coined in Florence.

Q. When were shillings coined?

A. In the reign of Henry the Seventh. Crowns and half-crowns, in the reign of James the First.

Q. What gold coins were used at first in England, besides Florentines?

A. Nobles, worth 13*s.* 4*d.*; rose-nobles, 6*s.* 8*d.*; then guineas, worth 21*s.*; and half-guineas, worth 10*s.* 6*d* But the gold coins now in use are sovereigns, worth 20*s.*, and half-sovereigns, worth 10*s.*

A. What were the ancient silver coins?

A. The most ancient was a mancus, worth 30 pennies of those days, or 90 of ours. It is thought by some to have been a mark; but a mark was 13*s.* 4*d.* The mancus was sometimes of gold. Our silver coin now consists of crowns, half-crowns, florins, shillings, sixpences, and fourpenny and threepenny pieces.

Q. Has any silver money of less value ever been coined?

A. Yes; twopenny, and even penny pieces.

Q. What gold coins are used in France?

A. The 20 franc or Napoleon, worth 15*s.* 10½*d.*; and the 40 franc, or double Napoleon, worth £1 11*s.* 8½*d.*

Q. What are the silver coins?

A. The quarter-franc, or 25 centimes, equal to 2½*d.*; half-franc, or 50 centimes, worth 4¾*d.*; franc, or 100 centimes, equal to 9½*d.*; the 2-franc piece, worth 1*s.* 7*d.*; and the 5-franc piece, equal to 4*s.*

Q. What are the copper coins?

A. The centime, the 100th part of a franc; sou, or 20th part of a franc; 2 sous, gros sou, or décime, the 10th part of a franc, equal to a little more than ¾ths of an English penny.

Q. What are the coins most in use in Germany and other countries?

A. In Germany, Flanders, Holland, and America, they use dollars, rix-dollars, ducats, and ducatoons; the florin, the stiver, the shilling, and the kreutzer and fenin.

Q. Which of these are gold?

A. The ducat, worth £6 15*s.* (a silver ducat is worth 7*s.* 6*d.*), and sometimes the florin, worth 2*s.* The silver coins are dollars and rix-dollars, each worth about 5*s.*, the florin, and the shilling. The Flemish shilling is worth $7\frac{1}{2}d.$ and the Dutch three-halfpence.

Q. Which are the copper coins?

A. The stiver, worth five farthings; the kreutzer, worth little more than a halfpenny; and the fenin. Three fenins are worth one farthing.

Q. Have other European nations coins, besides some of these?

A. Yes; in Italy, Spain, and Portugal they have pistoles, moidores, and doubloons; all of gold. The moidore is worth 27*s.*; the pistole, twice as much; and the doubloon is a double pistole, it is therefore worth £5 8*s.*

Q. Of what were the coins of ancient Rome and Greece made?

A. Of gold, silver, and brass. From the Roman names for their money, the letters £ *s. d.* are derived by the English.

£ stands for *libræ*, pounds; *s.* for *solidi*, shillings; and *d.* for *denarii*, pence.

Q. What are the Jewish coins mentioned in the Bible?

A. The gerah, worth about three halfpence; the bekah, worth 1*s.* 1½*d.*; the shekel of silver, worth 2*s.* 3*d.*; the talent of silver, worth £342 3*s.* 9*d.*; the talent of gold, worth £5,475.

Q. What are bank notes?

A. Bank notes are promissory notes for money to be paid on demand by a banking company.

Q. What is the lowest amount now printed on a bank note?

A. Five pounds; the next amount is for ten pounds; the next twenty; as the amount increases by tens.

Q. Where are bank notes made?

A. Principally at the Bank of England. The word bank comes from the Italian *banco*, a bench, because the ancient money-changers sat on benches in the market-place to transact their business.

Q. Which is the most ancient banking establishment?

A. That of Venice, in Italy, which, founded A.D. 1157, has served as a model for all subsequent ones.

Section 2.—Weights and Measures.

Q. Of what use are weights and measures?

A. They enable the seller and the buyer to receive an exact equivalent; the former, in money, for what he sells; the latter, in goods, for what he pays.

Q. Which are the different weights?

A. Troy weight, Avoirdupois weight, Apothecaries' weight, and Wool weight.

Q. For what is Troy weight used?

A. For weighing gold, silver, jewels, and precious stones. It is also used in ascertaining the strength of spirituous liquors, and in experiments for natural philosophy. But diamonds form an exception to the jewellery, being weighed by the *carat*, which is 4 grains. By one of the chapters in Magna Charta it is ordered that the same weight should be used throughout England, but Avoir-

dupois is now used for all articles that waste in weighing.

Q. When is Avoirdupois weight used?

A. It is used in weighing groceries, heavy goods, metals, excepting gold and silver, and every article of food, together with every substance used in the arts and manufactures.

Q. How was the weight of a pound decided?

A. It was found that 24 grains of wheat weighed exactly as much as an ancient silver penny, and twenty of these pennyweights made an ounce. The word ounce is derived from the Latin *uncia,* the twelfth part of any thing.

Q. Of what is an ounce the twelfth part?

A. Of a Troy pound: there are twelve ounces in a pound Troy weight, but sixteen in a pound Avoirdupois weight.

Q. What is the use of Apothecaries' weight?

A. It is used by druggists and

apothecaries in compounding their medicines, but they buy and sell their drugs by avoirdupois.

Q. What is the scruple used in Apothecaries' weight?

A. A scruple weighs twenty grains of wheat: the word is derived from the Latin *scrupulus*, the smallest of the Roman weights.

Q. From what is the word dram derived?

A. From the Latin word *drachma*, the eighth part of an ounce.

Q. For what is Wool weight used?

A. Only for weighing wool: the pounds are the same as avoirdupois, but different names are given to certain numbers of these pounds: 7 lbs. is a clove; 14 lbs. a stone, and so on.

Q. From what are these terms derived?

A. *Tod* is derived from the Gaelic word *tod*, signifying a *mass* of any thing. *Clove* comes from the Danish word *kloof*, to divide, separate; and *stone* is derived also from a Gaelic word signifying to *add*.

Q. What were the weights among the Greeks and Romans?

A. The highest weight was a libra, weighing about eleven of our ounces; this was divided again into lesser weights, the smallest a lentes, or scruple, scarcely weighing half a grain.

Q. What are the principal Jewish weights?

A. The shekel, weighing about half an ounce; the maneh, about 2 lbs.; and the talent, nearly 114 lbs.

Q. Are the French weights similar to ours?

A. The French use the pound weight, and they have also half and quarter pound weights.

Q. Are the French weights similar to ours?

A. They are partly so in name, but differ in other respects, for the French adopt the decimal system, of which the *gramme* is the unit or element of weight. In retail business the *livre usuelle* (common pound) is used, and is divided into halves, quarters, and eighths. The next denomination to livre is the *once*

(ounce), two of which equal the eighth of a livre, while the half of the quarter ounce is a *gros*, being the last denomination.

Q. How was long measure decided?

A. By the length of a grain of barley, taken from the ear when quite ripe: it was found that three of these barleycorns would measure one inch, which is the twelfth part of a foot.

Q. For what is long measure used?

A. For measuring lengths and distances. In measuring land, the denominations are leagues, miles, furlongs, poles, yards, feet, inches, and barleycorns.

Q. From what is the word league derived?

A. It is derived from the Celtic word *llac* (a flat stone), stones being used from the earliest times to mark distances. An English league measures 3 miles or 5280 yards; the great French one, 4400 yards.

Q. From what is the word mile derived?

A. From the Latin words *mil'*

passuum, a thousand paces, because the Roman mile measured a thousand geometrical paces or steps. An English mile measures eight furlongs, or 1,760 yards.

Q. Who determined the length of a yard?

A. Henry the First: it was the length of his own arm. A yard measures 3 feet, or 36 inches.

Q. What is the length of a fathom?

A. Six feet: the depth of the sea is generally measured by a line divided into fathoms.

Q. What were the measures among the ancient Greeks and Romans?

A. They had different names; but the Greeks used a measure called *pous*, a foot, about 13 inches in length. The Roman *pes*, a foot, measured 11 inches.

Q. What was the length of a Roman *milliare*, or mile?

A. About three-quarters of an English mile. The Grecian *milion*, or mile, was a few feet less.

Q. What are the Jewish long measures mentioned in the Bible?

A. The digit, about three-quarters of an inch; the palm, nearly 4 inches; a span, 11 inches; and a cubit, 22 inches. The giant, Goliath of Gath, must therefore have measured above 11 feet!

Q. What other measures had the Jews?

A. The fathom, measuring nearly $7\frac{1}{2}$ feet; and the measuring-line, 145 feet; a sabbath day's journey, mentioned in the Bible, was about three-quarters of an English mile.

Q. How is the yard divided for measuring cloth, linen, &c.?

A. Into halves and quarters: half a yard measures 18 inches; and a quarter, 9. The quarter is divided into four nails, each measuring $2\frac{1}{4}$ inches.

Q. Is the yard used as a measure all over Europe?

A. No; the French use a mêtre, measuring about $1\frac{1}{4}$ yard, and an ell, measuring $1\frac{1}{2}$ yard; this ell, with the English and Flemish ones, is used in

Holland, Flanders, Sweden, Switzerland, and great part of Germany.

Q. What does an English ell measure?

A. A yard and a quarter; a Flemish one, three-quarters of a yard.

Q. What is the general width of English goods?

A. Some goods are a yard wide; but the English, French, and Flemish ells are also used for many articles. French goods are usually ell wide.

Q What are the usual measures for liquids?

A. Ale, beer, and wine measures. These all have pints, quarts, and gallons: the larger measures differ only in the number of gallons they contain.

Q. How many gallons does a barrel of beer or ale contain?

A. Thirty-six.

Q. What is the difference in the hogshead?

A. A hogshead of wine contains 63 gallons; of ale or beer, 54.

Q. What were the ancient Jewish measures for liquors?

A. The hin, measuring a gallon and a half, and the ephah, rather more than 7 gallons.

Q. Are not pints, quarts, and gallons used for measuring dry goods ?

A. Yes ; for corn, fruits, and some vegetables. Coals were originally measured; now they are weighed by avoirdupois weight, 10 sacks of 224 lbs. each being equal to one ton.

Q. What are the measures used in dry measure ?

A. Pints, quarts, gallons, pottles, pecks, bushels, and strikes. The pints, quarts, and gallons are the same as liquid measures.

Q. What is the measure of a pottle ?

A. Two quarts, or half a gallon. There are 2 gallons to a peck ; 4 pecks to a bushel ; and 2 bushels to a strike.

Q. What is supposed to be the origin of these words ?

A. Most of them are likely to be the old Saxon names for the vessels used for measuring. The word pint is

said to be derived from the Greek word *vinta*, a vessel.

Q. What is the origin of the word quart?

A. It is from quarter, a quart being the quarter, or fourth part of a gallon.

Q. What were the dry measures used among the Jews?

A. The hin, measuring 9 pints; the cab, 2½ pints; the gomer, 5½ pints; and the ephah, 3 pecks and a pint.

CHAPTER III.

PRODUCTIONS OF THE EARTH USED FOR FOOD, MEDICINE, AND MANUFACTURES, ETC. ETC.

Section 1.—*Useful Seeds, etc.**

ENGLISH AND FOREIGN.

Q. What is considered the most useful European plant?

A. Wheat, or corn; it being the material of which bread is most generally composed.

Q. What is included, besides wheat, in the word corn?

*See also O'Brien's Simple Catechism of the Animal, Vegetable, and Mineral Kingdoms, page 49.

A. Barley, oats, and rye: bread has been made of all these in olden times, when wheaten bread was considered a luxury; and even nowamong the poor, in the northern counties and in Scotland, oats are used for bread and porridge.

Q. In what country was corn first cultivated?

A. In Egypt, which was anciently the most fertile of all other countries in corn. From Egypt it passed to Greece, Italy, and the other countries of Europe.

Q. Who is said to have taught the cultivation of corn to the Greeks?

A. Ceres, a Sicilian woman, and for this she was deified, and was called the goddess of agriculture.

Q. What is maize?

A. It is the general name for the seeds of Indian corn: it is also cultivated in America, and yields two crops a-year.

Q. In what countries is corn now generally produced?

A. In all European countries; in Egypt, Barbary, and some other parts

of Africa; and in most parts of America, when cultivated by Europeans.

Q. In what way is corn prepared to make bread ?

A. It is ground into flour, after the corn has been freed from the shell, or husk: this husk, when ground, is called bran.

Q. What is brown bread ?

A. Bread made of flour in which the grain has not been separated from the shell. The flour of barley and oats is called meal.

Q. Of what other use is flour ?

A. Besides using it as we do for pastry, the Italians make of it semolino, macaroni, and vermicelli.

Q. How are these made ?

A. Semolino is merely fine wheat ground or cut down into small grains; it is used for puddings. Macaroni and vermicelli are made of flour mixed with the white of eggs.

Q. In what shape are they made ?

A. Vermicelli is in the form of long thin threads, like worms; macaroni, like narrow pipes.

Q. What is the cause of this difference?

A. Vermicelli is forced through holes as small as possible, but macaroni through larger ones the size of a pea. Macaroni is sometimes made in the form of thin broad ribbons; it is then called sassagna.

Q. Of what are wafers made?

A. Of flour, isinglass, and yeast. When coloured with red-lead they are injurious to health, red-lead being a poison.

Q. When was baking first introduced into Rome?

A. After the war with Pyrrhus, 500 years after the building of Rome: every housewife was then her own baker.

Q. Have we not earlier accounts of baking than this?

A. Yes, in the Bible; and it is most likely that the Greeks, who introduced it into Rome, acquired their knowledge of it in Egypt.

Q. What other article besides bread is made from wheat?

A. Starch. By steeping wheat in

water, and then exposing it to the sun, a glutinous sediment is obtained, which, being then cleaned and dried in an oven, yields the above article.

Q. Of what use is starch ?

A. It is largely used by laundresses for stiffening linen, and by calico printers and bleachers.

Q. For what are oats now used ?

A. Besides being made into bread, &c., they are used as food for horses. Barley having been first steeped in water and then dried in a kiln produces malt, used in making what are called malt-liquors. Barley also forms the chief food of poultry.

Q. Of what other use are oats ?

A. When freed from their husks they are called groats, and are used to make gruel for sick persons.

Q. Of what use is rye now ?

A. Chiefly in the distillation of spirits, it being seldom made into bread except by very poor people.

Q. What is yeast and its use ?

A. Yeast is the scum or froth which rises in beer and other malt-liquors

during a state of fermentation: it is of the greatest importance in the making of bread, which without it would be heavy and unwholesome.

Q. What is pearl barley?

A. The small round kernel which remains after the husk or skin, and a considerable portion of the barley, have been ground off by the mill.

Q. What are hops?

A. The flower-buds of a beautiful plant which grows to a great height, twining round long poles. The best hop-grounds are in Kent.

Q. What is porter?

A. A kind of beer, first introduced about the year 1730: being a hearty and nourishing beverage, it was very suitable for *porters* and other hard-working people, and hence its name.

Q. What name was given, by the Egyptians, to liquor made from barley?

A. Barley-wine: it was also a favourite drink of the Anglo-Saxons.

Q. When were hops first used?

A. The first mention made of hops

is by the Arabian physician, Mesue, who lived about the year 845. They began to be used for beer, in Flanders, in 1500, and were cultivated in England about 1530.

Q. What is rice?

A. The grain of a cereal much cultivated in Eastern countries, and also in some parts of America. In India and China, where it yields two crops a-year, it forms the principal food of the poorer classes.

Q. Where does the best rice come from?

A. From Carolina, in North America; the grains are double the size of those that grow in the East Indies. Rice will not grow without plenty of water.

Q. What spirit is distilled from rice?

A. Arrack.

Q. What is millet?

A. The grain of a plant growing in the East Indies, various species of which are used as food for man and animals.

Q. What are caraway seeds?

A. The seeds of a British plant: they are hot and pungent, and are used in confectionery and medicine.

Q. What are coriander seeds ?

A. The seeds of a plant, a native of England, but which also grows in India. They are used by druggists, confectioners, and distillers.

Q. What did the ancients imagine about this seed ?

A. That the juice of the coriander seed would render a person insensible.

Q. What are cardamoms ?

A. Seeds brought from the East Indies in pods: useful in medicine. The Indians mix them with the betel, and chew them; and also use them in their soups, curries, &c.

Q. Where do the best capers come from ?

A. From the south of France: where they grow wild on a small shrub, flourishing most near ruins or in cavities of rocks.

Q. What is anise seed ?

A. A seed used for medicine, growing wild in Egypt, but cultivated in

Spain and Malta, whence the seed is imported.

Q. What is linseed-oil made from?

A. It is made from the pods and seeds of flax, a beautiful plant growing in this country. From the fibres of the stalks linen is made.

Q. What is rape seed?

A. The seed of a plant which grows in a rich soil, in several parts of England. Oil is made from it, as well as oil-cakes for fattening cattle.

Q. What is castor oil produced from?

A. From the seeds of a plant called by the Americans Palma Christi, growing in both the Indies. The seeds are pressed, and boiled in water till the oil rises to the top, when it is carefully skimmed off and kept for use. It is a mild purgative.

Q. From what is soy made?

A. From the seeds of a Japanese plant called Soya; it is chiefly used as a fish sauce.

Section 2.—Plants and Shrubs.

Q. Where does the tea-shrub grow?

A. In China, Japan, and Siam: it is an evergreen, and the leaves are dried for use.

Q. What is the difference between the plants on which green and black tea grow?

A. Some travellers suppose it to be the same plant; but botanists tell us that the flower on the black-tea shrub has six petals, or leaves, and the green-tea flower has nine.

Q. What does the flower resemble?

A. That of our white wild-rose; the root is like that of the peach-tree.

Q. Which is considered the most expensive tea?

A. That in which the leaves are gathered when very young. There are three seasons for gathering the leaves.

Q. When is the first?

A. In March, when the leaves are only a week old; the second in April, and the third in June.

Q. How old must the tree be before the leaves can be gathered ?

A. Three years; the finest shrubs are kept for the emperor: this is called imperial tea.

Q. What are the names given to black tea ?

A. Bohea, congou, souchong, and pekoe.

Q. What are the names of the green teas ?

A. Singlo, hyson, and gunpowder.

Q. How is tea prepared for use ?

A. When the tea leaves have been collected, they are exposed to the steam of boiling water, after which they are put upon plates of copper and held over the fire until they become dry and shrivelled, and appear such as we have them in Europe.

Q. What is gunpowder tea ?

A. The unopened leaf-buds: they are gathered and dried so carefully that they retain more of their flavour and colour. It derives its name from its resemblance to the grains of gunpowder.

Q. Who first introduced tea into England?

A. Lord Ossory and Lord Arlington who brought it from Holland, the Dutch having been the first to import it into Europe in 1610.*

Q. In whose reign was tea introduced?

A. In the reign of Charles the Second, and was generally sold at fifty shillings a pound.

Q. What is coffee?

A. The berry of an evergreen shrub; when ripe it is red, something like our cherry. It is first dried, then roasted, and, before we can use it, ground to powder in a coffee-mill.

Q. Where does the best coffee come from?

A. From Mocha in Arabia; Jamaica was the first of the West India islands in which coffee was planted.

Q. From what is chocolate made?

A. From the pulp of the cacao, or

* See Erredge's Student's Handbook of General Information, page 60.

chocolate nut: it is mixed with sugar, cloves, cinnamon, and other spices.

Q. Where does the cacao-tree grow?

A. In South America and the West Indies: it has a beautiful flower, and the fruit is enclosed in a pod, something like a cucumber in shape. The nuts are like almonds, twenty or thirty in one pod.

Q. When was chocolate introduced into Europe?

A. About the year 1520, being brought by the Spaniards from Mexico and the Brazils. It was sold in London coffee-houses in 1650.

Q. What is sugar?

A. A very sweet juice pressed out from the sugar-cane, a plant which grows to the height of seven or eight feet, and is a native of the East and West Indies.

Q. What is treacle?

A. The remains of the sugar syrup: it is sometimes called molasses. A spirituous liquor, *rum*, is distilled from the sugar-cane, or from the molasses.

Q. What is arrow-root?

A. A kind of starch manufactured from the root of a plant which is a native of South America, but is cultivated both in the East and West Indies.

Q. From what is its name derived?

A. From the use made of it by the Indians, the juice having the power of curing wounds made by poisoned arrows, &c. &c.

Q. What are cloves?

A. The dried buds of a small aromatic plant growing in the Moluccas.

Q. What is pepper?

A. The berry of a creeping shrub: the berries grow in clusters, like currants, and are first green, but when ripe, red.

Q. What is the difference between black and white pepper?

A. The unripe grains or corns are called *black* pepper; the ripe ones, denuded of their skin, constitute *white* pepper.

Q. What is ginger?

A. The root of a reed-like plant

growing in Calicut and many places in Asia and the West Indies; it spreads far under ground, the plant itself resembling a rush.

Q. In what way do the Indians use it?

A. When fresh it is soft, and eaten like a salad; it also makes a delicious preserve.

Q. What is the orris-root?

A. The root of a white flowering plant, a native of the south of Europe. In a dried state it communicates a grateful scent like that of violets.

Q. What is liquorice?

A. A root which grows wild in the south of Europe, &c., is cultivated in many places, even in England. The extract known as Spanish liquorice is manufactured in Spain, and great quantities of it are annually imported into this country, to be used in the adulteration of porter and as a medicine.

Q. Where do yams grow?

A. In Africa and the East and West Indies. The yam is a species of vine, having large tuberous roots,

which are eaten either roasted or boiled, while the flour is often made into bread and puddings.

Q. What are capsicums?

A. The pods of an American and Indian plant. Capsicums, either green or ripe, are very much eaten in hot climates, and in Europe are much esteemed as pickles.

Q. From what is cayenne pepper made?

A. From a kind of capsicum growing in Cayenne, a town in French Guiana, in South America.

Q. What is garlic?

A. The bulbous root of a plant which grows wild in Sicily and in other parts of Europe: although its smell is very strong, and to some persons offensive, yet this root is much used in cookery, especially on the continent.

Q. Is it not valuable in medicine?

A. Yes: the juice also forms a very strong cement for broken glass. Leeks are a kind of mild onion sometimes used in broths and soups, and they are particularly esteemed by the Welsh, who

wear them, as a badge, on St. David's day, in honour of their patron saint.

Q. Is there another kind of garlic?

A. Yes, shalots; much used by the French in cookery. Onions are the roots of a plant having a mild flavour of the leek, and are much used in cookery. Spanish onions are considered superior to all others.

Q. What is the Canadian onion?

A. A plant on which the onion grows at the top of the stalk instead of at the root.

Q. Where do mushrooms grow?

A. They grow wild in England, in parks or other places where the turf has not been ploughed up for many years.

Q. What are morrels?

A. Another kind of fungus, used for broths and soups.

Q. What is madder?

A. The root of a creeping plant used by dyers and painters for obtaining a fine scarlet colour, and is imported into this country from the Levant and Holland. It grows wild in many parts

of Europe; and when eaten by cows, who are very fond of it, it imparts a fine yellow tint to their milk, and consequently to the butter made from it.

Q. What is flax?

A. The produce of a beautiful plant with slender stalks, small leaves, and blue blossoms. Of the fibres of the stalks linen and cambric are made.

Q. What island is famous for linen?

A. Ireland; it is also very perfect in Holland; cambric takes its name from Cambray, in Holland, at which place it was first manufactured.

Q. What is hemp?

A. A useful plant growing in England; the fine fibres of the stalks are spun into coarse cloth and canvass, and the coarser are made into twine, ropes, cables, and cordage.

Q. What is tow?

A. It is flax or hemp beaten and combed into a thread-like substance: it is used for various purposes, such as stopping an effusion of blood, &c.; twisted round the handle of an instrument it renders the grasp of it more firm.

Q. What is cotton? *

A. The wool or down surrounding the seeds of various species of the gossypium, or cotton plant, or shrub, which is cultivated in the East and West Indies, North and South America, and other parts of the world.

Q. What is the use of cotton?

A. It is spun into calicos, muslins, dimities, and many other stuffs. A buff-coloured cloth is made in China from a species of yellowish cotton grown in the Nankin district; whence the stuff itself is called *nankeen.*

Q. From what is indigo produced?

A. Indigo is obtained from the leaves of various species of *Indigofera,* largely cultivated in India and America. The leaves being bruised and fermented in water, a blue powder is deposited, which is collected and dried so as to form the cakes sold in the shops. It yields a deep purple.

Q. Where is logwood found?

A. In Jamaica, Campeachy, and

* See also Erredge's Student's Handbook of General Information, page 46.

Honduras. It is principally used in dyeing, particularly black and violet.

Q. What is woad?

A. A plant, the leaves of which, after undergoing a certain process, are used in dyeing black and blue; but indigo is now generally substituted for it. The ancient Britons stained their bodies with woad.

Q. What is weld?

A. It is a plant much cultivated in Kent for the use of the London dyers. With the help of potash it yields a deep lemon colour.

Q. What is turmeric?

A. It is a root brought from Madagascar and the East and West Indies, and is used by dyers for producing a yellow colour: turmeric is also employed in medicine, as beneficial in cases of dropsy, jaundice, &c.

Q. What is tobacco?

A. A plant growing in America much used in smoking, chewing, and for snuff.

Q. Whence does it take its name;

and when was it first brought into England?

A. This plant received its name, from Tabacco, a province of Yucatan some, however, say that it is derived from the island of Tobago. It was first brought to England in the reign of Queen Elizabeth, 1565, by Sir John Hawkins, although its first introduction has been ascribed to Sir Walter Raleigh.

Q. What vegetable was brought into England about the same time?

A. The potato. Potatoes were brought to England from Santa Fé in America, by John Hawkins, in 1563, but Sir Walter Raleigh first planted them in Ireland, at Youghall, near Cork, in 1586.

Q. Who first planted cabbages in England?

A. Sir Arthur Ashley, of Dorset, three varieties of this plant having been brought from Holland in 1510. A species of the Brassica plant, which grows on cliffs by the sea in many parts of England and Scotland, is the origin of our garden cabbage.

Q. When were other vegetables introduced into this country ?

A. Peas and beans by the Romans; but first cultivated in England in the reign of Henry VIII. Artichokes in 1487 ; asparagus in 1602, and turnips about the same time.

Q. What is rhubarb ?

A. A root of great medicinal qualities, introduced into Europe from China by Turkish traders, and was first cultivated in England in 1763. The rhubarb plant is much used in England for tarts.

Q. From what place have we senna ?

A. From Alexandria in Egypt ; the leaves are dried and used for medicine.

Q. What is peppermint ?

A. An aromatic and pungent plant, growing in wet marshy grounds in some parts of England: peppermint water is distilled from it.

Q. What is ipecacuanha ?

A. The root of a plant growing in Brazil in South America; very useful in medicinal cases.

Q. Where do aloes grow ?

A. In various parts of Asia, Africa, and the West Indies, but especially in Socotra. The juice is pressed from the fresh leaves, and, when dried in the sun, it becomes hard, and is a very valuable medicine.

Q. What colour is produced from aloes ?

A. A beautiful violet. The Mahometans and Egyptians consider the plant as sacred, and hang it on their doors when they return from a pilgrimage to Mecca.

Q. Is not the Chinese aloe very useful ?

A. Yes, the inner bark when burnt yields an agreeable perfume, and the branches taste like candied citron.

Q. Of what use is the root ?

A. Ropes are made of it. The Indians cover their houses with the leaves ; and the fibres are made into thread.

Q. What is quassia ?

A. The root of a tree growing in North and South America, and the

West Indies. It took its name from the slave who first used it in Surinam to cure fevers. The bark and wood, as well as the root, are all useful in medicine.

Q. What is saffron ?

A. A plant first brought into England from the east by a pilgrim in 1389. It was cultivated in England in 1582. The best grows in Essex, between Cambridge and Saffron-Walden : saffron is used both in food and medicine, and also in dyeing.

Q. Where do mint and thyme grow?

A. In England—they are very useful herbs, and were brought from Persia.

Q. What is sorrel ?

A. A wild sour herb growing in England. Salts of lemon, used for taking ink-stains out of linen, are made from it.

Q. What are camomile flowers ?

A. The flowers of the plant of that name, a native of England. The flowers when dried are very useful as a stomachic medicine

Section 3.—Useful Trees and Fruits, etc.

Q. What are the names of the principal English trees?

A. The oak, the elm, the fir, the beech, the ash, the poplar, the walnut, and chestnut.

Q. Of all these trees which is the most valuable?

A. The oak, on account of its strength and durability; on which account oak timber is used in the building of ships and houses. The best oak for naval purposes grows in the forest of Dean, Gloucestershire.

Q. Is not every part of the oak valuable?

A. Yes, the bark is used by tanners and dyers, the ashes to purify and cleanse wine, and even the sawdust is of use.

Q. What is made of the root?

A. Handles for knives, hammers, &c.; and the acorns provide food for deer and hogs.

Q. Has the bark any other use?

A. Yes, for medicinal purposes.

the branches are burned for charcoal.

Q. Does the oak live to a great age?

A. Yes, one was cut down in Wales, which had been growing 400 years.

Q. How is the age discovered?

A. By counting the rings in its trunk; it forms a fresh ring every year.

Q. What tree is next in beauty to the oak?

A. The elm; the wood is used for water-works, mills, pipes, and pumps; also for picture-frames, coffins, and carved works.

Q. Of what other use is the elm?

A. The branches are burnt to make charcoal, and cattle are sometimes fed on the leaves; the charcoal is nearly as good as that of the oak.

Q. What is the wood of the fir-tree called?

A. Deal; it is very useful for floors, wainscots, and other common purposes. The best deal comes from Norway.

Q. Of what other use is the fir-tree?

A. Turpentine, pitch, tar, and rosin are obtained from it.

Q. In what way?

A. A hole is cut in the bark during the spring, and the sap or juice which runs out forms common turpentine. After it is prepared, a thick matter settles at the bottom, called yellow rosin.

Q. Of what use is the tree after this?

A. It is cut down, sawn in pieces, and burnt in a pit. While burning, a black thick matter runs from it called tar.

Q. What is pitch?

A. Tar boiled with water, and sometimes rosin; pitch, mixed with rosin and oil, makes shoemakers' wax; and, when mixed with fat, carriage grease.

Q. Is the ash useful?

A. Yes, the wood is used for handles for various implements, for ploughs, harrows, axle-trees, and oars for boats.

Q. Of what use is the beech?

A. The wood is used by turners and cabinet-makers for fancy articles,

as it is clean, white, and finely grained, and not apt to bend or slit.

Q. Are not the walnut and chestnut trees used for the same purposes?

A. Yes. Their wood is more adapted for joiners, being less subject to worms; it is also more beautifully grained, and of a browner colour. The wood of the chestnut is very lasting.

Q. Of what use is the poplar?

A. Wooden vessels, and soles and heels of shoes, are sometimes made of it; the timber is also useful to carpenters.

Q. What other trees are useful for manufacture?

A. The lime, the willow, the box, the holly, the maple, the plane, the cypress, and the yew tree.

Q. Of what use is the lime or linden-tree?

A. The lime has a beautifully scented blossom, of which the bee is very fond; the wood is used by carvers, and makers of pill-boxes.

Q. What is made of willow twigs?

A. Baskets, cradles, and all sorts of

wicker-work. Osiers are low willow-trees, used for hampers, hurdles, &c.

Q. Of what wood are tops and chessmen made?

A. Of boxwood. The maple, the box, and the holly are mostly used for fancy articles; violins and musical instruments are often made of maple, because of its lightness.

Q. What are the uses of the holly?

A. Birdlime is prepared from its bark. Its timber, which is the whitest of all hard woods, and takes the finest polish, is used by inlayers. The boughs with the red berries decorate rooms at Christmas-time by way of rejoicing.

Q. What ancient people used it for the same purpose?

A. The Romans; they also valued maple wood, and had expensive tables made of it.

Q. Was not the plane-tree much valued by the Greeks and Romans?

A. Yes; and, on account of the agreeable shade it afforded, was planted in the avenues to their villas.

Q. What kind of tree is the cypress ?

A. A tree whose wood is of an agreeable smell, and that scarcely ever decays ; it was originally found in the island of Cyprus, and was used by the ancients as a token of sorrow. The cypress was brought into England about 1441.

Q. By whom was the wood considered very valuable ?

A. By the ancients. It is of a pale red colour, with deep veins, and very durable. Pliny, the Roman historian, tells us that the gates of the temple of Diana were made of it, and that, although in his time they were 400 years old, they were still in excellent preservation.

Q. How does it happen that so many yew-trees are planted in churchyards ?

A. The wood of the yew-tree was used for the making of bows in the time of the Normans, when bows and arrows were used in battle. William the Conqueror, therefore, ordered yew trees to

be planted in every churchyard, that there might be always a supply of that kind of wood.

Q. Are not many other English trees useful ?

A. Yes, the wood of the pear-tree is often used, and many others, as the sycamore, the larch, the aspen, the acacia, the laburnum, &c. ; but these, and indeed all trees, are considered as ornaments to a landscape, and are seldom cut down unless necessity require.

Q. Mention some foreign trees useful for manufacture ?

A. The teak, the mahogany, the cedar, the ebony, the jacaranda or rosewood, and the bamboo.

Q. What is the teak-tree ?

A. It is called the oak of the Eastern world, and is used for shipbuilding ; it is a native of Pegu, and grows on the coast of Malabar, and in all parts of Bengal.

Q. What tree produces mahogany?

A. One which grows principally in Jamaica, Cuba, and St. Domingo, the West India islands, and in the

southern parts of Honduras and East Florida.

Q. Which is considered the best mahogany ?

A. The Jamaica wood, for beauty of colouring, firmness, and durability, is most valued ; it takes a most brilliant polish. Mahogany has been used in medicine with the same effect as Peruvian bark.

Q. What is the cedar-tree ?

A. An evergreen, the native of no place but Mount Lebanon. It is a tree of great beauty and durability. Solomon's temple and palace were built of cedar, and historians tell us that some of this timber was found in the temple of Apollo at Utica, 2000 years old.

Q. What is ebony ?

A. A species of hard, heavy, and durable wood, brought from Ceylon and Madagascar, and which is capable of a very fine polish, being on that account used for inlaying and other ornamental work. The most usual colour is black, red, or green, but the best is a jet black. Ebony yields an agreeable

perfume when laid on burning coals. Green ebony is used as a dye-wood.

Q. What is rosewood ?

A. A dark beautiful wood, often used for furniture in preference to mahogany; it grows in Jamaica and the Brazils. It has a fragrant smell, and from it is obtained a perfume used in scenting pomatums, &c.

Q. Is the bamboo a tree ?

A. No, it is a plant of the reed kind, growing in the East Indies, and other warm climates, to the height sometimes of 80 feet. Bamboos are turned to almost every use, for posts and buildings, masts, water-pipes, pitchers, drinking cups, cooking utensils, &c. ; when split they are made into mats and sails.

Q. What is sandal-wood ?

A. The wood of a tree growing in Siam ; it is used for fans, toys, and ornaments, and small pieces are burnt in India on account of its beautiful scent ; perfume is also extracted from it.

Q. What use is made of it in China ?

A. The Chinese make coffins of it, and perfume their persons and houses with it.

Q. What is satin-wood ?

A. The wood of a beautiful tree growing in the Brazils and Jamaica, used for inlaying.

Q. Mention some English fruit-trees.

A. Apples, pears, plums, cherries, peaches, apricots, nectarines, damascenes, mulberries, grapes, medlars, melons, and the various kinds of nuts.

Q. What are the fruits growing on shrubs or small plants ?

A. Gooseberries, raspberries, currants, and strawberries.

Q. Are any of these trees and plants natives of England ?

A. Only the common nut; as acorns, nuts, and crab-apples were the only fruit in the island when it was conquered by the Romans.

Q. From what country was the apple-tree brought ?

A. It was first brought into Italy from Syria and Africa, 90 years B.C.,

but several kinds are indigenous in England; those however in general use have been brought at various times from the continent. A great number of the orchards in Kent are said to have been planted by Richard Harris, fruiterer of Henry VIII.

Q. Will not all fruit-trees grow from the pip of the fruit?

A. Not to produce good fruit; the plant growing from a pip is only wild, and must be ingrafted with good fruit before it will come to perfection.

Q. From what country were pears brought?

A. From Italy. The wood is used for picture-frames, tools, and common rulers.

Q. What pleasant drinks are made from apples and pears?

A. Cider from apples, and perry from pears.

Q. From what are plums produced?

A. The greengage and the magnum bonum, or egg plum, are both produced from the wild plum or bullace. Plums were brought to this country from

France, and, when dried, are exported from thence in large quantities ; they are then called prunes, or French plums.

Q. From whence had we cherries?

A. Cherries grew wild in the woods near Cerasus in Pontus, on the Black Sea; from Cerasus the name is corrupted to cherries. They were brought to Rome by Lucullus, a Roman general, 70 years B.C.

Q. When were they first planted in England ?

A. Cherry-trees were first planted in Britain 100 years B.C., but the finer kinds were afterwards brought from Flanders in the reign of Henry VIII., and planted in Kent. The wood of the tree is very useful.

Q. What country produced the peach ?

A. Persia ; the nectarine is a kind of peach. Apricots and quinces came from Epirus, Carthage, and Asia Minor.

Q. Where is Epirus ?

A. In Greece. Carthage was a city

in Africa, founded by Queen Dido; Tunis now stands on its ruins.

Q. What is the word apricot derived from?

A. From the Latin word *apricus*, which signifies sunny. The apricot is supposed to be a native of Africa.

Q. What are medlars?

A. A native English fruit found growing wild about a hundred years ago. They are kept in bran for a fortnight, and sent to table half rotten. The wood of the tree is used for walking-sticks.

Q. From what country were melons brought?

A. From some of the islands of the Levant; it is a sort of cucumber, eaten when ripe, and is raised under glass in this country.

Q. What are water-melons?

A. Another species, equally cooling and delicious. The pulp is gene rally of a red colour.

Q. Is the cucumber a fruit?

A. Yes; it is eaten before it is ripe, with pepper, salt, and vinegar.

The young cucumbers, when pickled, are called gherkins. The plant was brought from the Netherlands about 1538.

Q. Are nuts natives of England?

A. Only the common nut. Philibert, King of France, caused this nut to be improved, and hence it was called Filbert. Chestnuts come from France and Spain.

Q. What is the difference between this chestnut and the horse chestnut-tree?

Q. The leaves of the Spanish chestnut are long and pointed, with notches at the edges. The horse chestnut is also enclosed in a prickly shell. From the horse-chestnut excellent flour and starch have been made.

Q. When was the first gooseberry-bush planted in England?

A. In the reign of Henry VIII. it was brought from Flanders.

Q. Do not several berries form delicious fruit?

A. Yes, strawberries and raspberries are supposed to be the common black-

berry in a highly cultivated state; cranberries, elderberries, whortleberries, grow wild, and are very useful.

Q. Where was the first mulberry-tree planted?

A. At Sion House, the seat of the Duke of Northumberland. The Morea in Greece is famous for mulberry-trees, and takes its name from *morus*, a mulberry-tree.

Q. What are the different kinds of grapes?

A. Red and white grapes, raisins or dried grapes, and currants or Corinthian grapes.

Q. Is the black, white, and red currant a species of small grape?

A. Yes; the first tree was brought from the island of Zante, and planted in England in the reign of Henry VIII. They were called Corinthian grapes, and the word Corinthian was in time corrupted to currants.

Q. Is Corinth now famous for these grapes?

A. No. The dried currants used for puddings, &c., and exported to other

countries in great quantities, are now prepared in Zante; for the Turks not allowing vessels to sail to the Morea for the currants, the cultivation of them was therefore neglected.

Q. What country produces the finest grapes for table?

A. England, by artificial heat in hot-houses: a bunch of grapes weighing 19½ lbs. was produced in the vinery of the Duke of Portland.

Q. Where are the finest vineyards?

A. Between Rome and Naples; they are trained from the branches of elms and poplars.

Q. Are many foreign fruits produced in hot-houses?

A. Yes, with great care and attention, oranges, pine-apples, figs, and several others may be produced, but they are not so fine as those brought from their native country.

Q. Where do oranges grow?

A. In the islands of, and places near, the Mediterranean; also in China. The perfume called Bergamot is made from the rind of the orange.

Q. Where do the Seville oranges grow?

A. Near Seville, a town in Spain: although not sweet, they are useful in medicine and cookery.

Q. What is the shaddock?

A. A kind of orange, sometimes as large as a child's head; it takes its name from Captain Shaddock, who took it from China and planted it in the West Indies, where it grows as well as in China.

Q. From whence are lemons brought?

A. From Spain and Portugal. The lemon-tree is a native of Asia Minor. The lemon is useful in medicine and cooking, and the juice will take out iron-moulds.

Q. What are the citron and lime?

A. Both species of lemons, but the citron is larger, and the lime smaller than the lemon. The lime grows in North America and the West Indies.

Q. Where do the finest figs come from?

A. From Spain; they are dried and

packed in boxes in the shape of a drum. The wood of the fig-tree is much valued; in Eastern countries coffins are made of it.

Q. Where are pine-apples plentiful?

A. In Sierra Leone in Africa, but they are brought to England now in great quantities by steam from North America and the West Indies.

Q. Mention some other foreign fruits.

A. Almonds, cocoa-nuts, Spanish and Brazil nuts, dates, guavas, mangoes, nutmegs, olives, allspice, pomegranates, and tamarinds.

Q What are nutmegs?

A The kernel of a fruit growing in the East Indies. It has four covers, the first like our walnut, thick and soft; the second, a thin reddish coat, with an aromatic smell and taste.

Q. What is this red shell called?

A. Mace: it is useful in cookery; the shell under the mace is hard and black, and under this is a thin green skin of no use, which encloses the nutmeg.

Q. From whence have we almonds?

A. From Spain, France, and Italy: they are enclosed in a tender shell, and the fruit yields a great deal of oil when pressed. The oil of the bitter almond is poisonous.

Q. What are cocoa-nuts?

A. A fruit growing in most hot climates. The tree grows to a great height, and has leaves only at the top; the fruit hangs in clusters like grapes, twelve or fourteen together.

Q. Has the cocoa-nut more than one shell?

A. Yes; it is enclosed in a rough fibrous shell, sometimes as large as a child's head, but egg-shaped. The inner shell is round, and contains milk; when fresh, it is a delicious fruit.

Q. What use is made of the shells by the natives?

A. Of the outer one, sails, cloth, and cordage are made; from the inner shell, ornaments, cups, spoons, &c.; and from the trunk of the tree they make their boats.

Q. Where do the small nuts grow which are eaten at table?

A. In Spain; they are called Spanish or Barcelona nuts, and are about the size of our wild nut. Brazil nuts are long, brown, and flat at the sides; they come from Brazil in South America.

Q. Where does the date-tree principally grow?

A. On the African coast of the Mediterranean; it is also called the palm-tree, and the leaves, which grow at the top, are sometimes eight or nine feet long.

Q. What is the shape of the fruit?

A. It generally resembles a large acorn, but sometimes is larger, and round like an apple. There are also black, white, and brown dates.

Q. What are guavas?

A. A wholesome West Indian fruit; it is sometimes eaten raw, but generally as a sweetmeat or jelly.

Q. Where do mangoes grow?

A. In the East Indies. Those we see in this country are pickled, or,

while unripe, preserved. When ripe, the fruit is the size of a goose's egg, and the smell is so refreshing that it is supposed to restore people to health.

Q. What are bananas ?

A. The fruit of the plantain-tree, cultivated in the East Indies. It grows to fifteen or twenty feet high ; the leaves are sometimes eight feet long, and grow in clusters at the top like the palm and cocoa-nut trees.

Q. Of what shape is the fruit ?

A. That of the cucumber. The bunches in which it grows sometimes weigh above forty pounds. The negroes make it their chief food.

Q. Where do olives grow ?

A. In Italy, Spain, and the South of France. They are pickled, but not considered wholesome for delicate persons on account of the oil they contain.

Q. Is this oil useful ?

A. Yes ; it is called sweet oil, or oil of olives, and is used in dressing salads, and for many other purposes.

Q. What are tamarinds ?

A. The pulp of a fruit growing in

India, by some people called the Indian date. The tree is like our ash-tree, and the fruit grows in a pod. Tamarinds are useful as a medicine, and as a preserve.

Q. Where do pomegranates grow?

A. They are natives of Granada in Spain. The fruit, which is like an apple, but with a thick brownish rind, grows on a shrub like the myrtle. The blossoms are purple.

Q. What is allspice?

A. The fruit of a beautiful tree growing in Jamaica, called the pimento. It is called allspice because it is supposed to taste like all other spices; we use it ground into powder.

Q. What is the betel-nut?

A. The nut of a kind of palm-tree, growing in India. In India betel is taken after meals and during a visit: it is offered to friends when they meet and when they separate; in short, nothing can be done without betel. They also carry it about like snuff.

Q. Where does the bread-fruit-tree grow?

A. It is a native of the South Sea Islands, where it attains the thickness of a man's body, and the height of 40 feet. The fruit is the size and shape of a child's head, and is covered with a thin skin, the edible part being between the skin and core, as white as snow, and of the consistence of new bread. When ripe it is pulpy and sweetish, but when green it is farinaceous, and forms wholesome food, either when baked or roasted.

Q. Where is the butter-tree found?

A. In Bambarra, in the centre of Africa. It yields a kind of fruit like vegetable marrow; from this fruit oil is extracted by boiling; which, when cool, is made into cakes and used as butter.

Q. Besides the bread and butter trees, is there not a tree called the cow-tree?

A. Yes; it grows in America; the branches appear dead, but when the trunk is pierced it yields sweet milk.

Q. What other parts of trees are useful besides the trunk and the fruit?

A. The bark, the leaves, the flowers, the pith, and the gum found on many trees are all useful.

Q. Of what tree is cinnamon the bark?

A. Of a tree growing in the island of Ceylon; it is the under bark of the branches. The leaves, fruit, and root yield oil, of which candles are made for the king, on account of their fragrant smell while burning. Cinnamon is used as a spice and medicinally.

Q. From what is sago prepared?

A. From the pith of several different plants. The sago sold in England is principally imported from the islands of the Indian archipelago, and is the produce of a plant called the true sago palms.

Q. What is cork?

A. The bark of a beautiful tree like the oak, growing in Spain; it is soaked and dried for use. The Egyptians made coffins of cork.

Q. What is Peruvian bark?

A. The bark of the quinquina-tree, growing in Peru, very useful in medi-

cine. The Jesuits discovered it, and it is often called Jesuits' bark.

Q. What is India-rubber?

A. The gum or juice of the syringa-tree, growing in Guinea, Quito, and Cayenne. As the gum flows it is taken and dried, or made into boots, bottles, cloth, and many useful things.

Q. What is the black varnish used in Japan and China?

A. The gum of the cashew-nut-tree, and whatever it touches is stained a deep black. Our japanned articles are imitations of this.

Q. Why are they called japanned?

A. Because the first beautiful things varnished in this way were brought from Japan.

Q. What is gum-arabic?

A. The gum of a tree growing in Egypt, Turkey, and places near the Persian Gulf. It is used by dyers and water-colour manufacturers, and also in medicine.

Q. What is pounce?

A. A resinous powder used to sprinkle over fresh-written documents,

consisting of gum-sandarac, pounded and sifted very fine, and mixed with the bone of the cuttle-fish, crushed.

Q. Of what use are juniper berries?

A. They are used in medicine as carminatives and stomachics, while the oil which is obtained from them, mixed with that of nuts, makes an excellent varnish ; and is also extensively used to flavour gin.

Q. What is manna?

A. A gum flowing from a kind of ash-tree, growing in Italy and Sicily, very useful as a medicine.

Q. Is not myrrh also a gum?

A. Yes; it flows from a kind of tree like the acacia ; frankincense is also another gum, which when burnt has a very fragrant smell.

Q. Is there a tree called the tallow-tree?

A. Yes; the kernel of the fruit is melted by the Chinese to make candles; they add a little oil, and colour it with vermilion : it is better than tallow, although not so good as wax.

Q. What is opium ?

A. The juice of the white poppy; it is used as a medicine, but, when too much is taken, is a deadly poison.

Q. Is not gutta percha a gum?

A. Yes; it is a concrete milky juice, forming a gum-resin, obtained in the eastern archipelago from a tree called the Isonandra gutta; it is of extensive use in the arts, and for various domestic purposes, being easily shaped, and retaining the form given to it.

Q. What is camphor?

A. A concrete acrid juice from the Indian laurel-tree, which grows wild in Borneo, Sumatra, &c. It has a bitterish aromatic taste, and a very fragrant smell, and is of great use in medicine.

Q. What is attar of roses?

A. It is the essential oil of roses. Herat, in Persia, is noted for this beautiful perfume. Roses were first brought to England from Persia.

Q. What is benzoin?

A. A thick white gum, which oozes from a tree growing in the island of Sumatra; it is very useful in making friars' balsam and for healing cuts.

Q. Is it not used to make court plaster?

A. Yes; isinglass is dissolved and spread over black sarsenet, and this is afterwards washed over with benzoin and spirits of wine.

Q. What is gum guaiacum?

A. The gum of a tree growing in the West Indies; the bark and flowers are also used as medicine, and the wood is very valuable. The tree is called lignum vitæ.

Q. What is copal?

A. The gum of a tree growing in New Spain; mixed with spirits of turpentine, it makes a transparent varnish.

Q. What is balm of Gilead?

A. The dried juice of a small shrub growing in Abyssinia and Syria; only sixty drops can be procured from one tree daily. Balm of Gilead was one of the presents sent by the Queen of Sheba to King Solomon.

Q. What is asafœtida?

A. A fetid thick sap from a large plant which grows in Persia and the East Indies; it is much used in medicine as a remedy for spasms.

CHAPTER IV.

ANIMALS, BIRDS, INSECTS, ETC., USED FOR MANUFACTURES AND FOOD, ETC.

Section 1.—*Quadrupeds.**

Q. Which are the most useful quadrupeds?

A. Horses, oxen, and sheep. Horses, besides being employed as beasts of burden when living, are also useful when dead.

Q. In what way?

A. The hair of the mane is used for stuffing mattresses, chair-seats, and saddles; and the hair of the tail is woven into cloth for covering chairs and sofas: fishing lines, sieves, and bows for violins, &c., are also made from it.

Q. Is the skin useful?

A. Yes; it is used to make collars, traces, and other parts of harness.

Q. Of what use are the cow and the ox?

A. While living, the cow provides

* See also O'Brien's Simple Catechism of the Animal, Vegetable, and Mineral Kingdoms, p. 4.

us with milk, from which we have cream, and from cream are made butter and cheese.

Q. Of what use is the ox ?

A. The ox provides us with food, after being slaughtered ; of the skin leather is made ; and the horns are made into spoons, cups, handles for knives, and also used instead of glass for lanterns. The hair is mixed with lime to make mortar.

Q. Is oil made from any part of the ox ?

A. Yes ; from the feet, called neat's foot oil. The refuse of their fat is also made into tallow for candles.

Q. What is rennet ?

A. The gastric juice, or concreted milk found in the stomach of a sucking quadruped, particularly of the calf : after being prepared by salting in water for some weeks, it is used for curdling milk, in order to make curds and whey.

Q. What is vellum made from ?

A. The skin of calves.

Q. What is the buffalo ?

A. A kind of wild ox. Butter

made from the milk of the buffalo, is called by the Indians, ghee.

Q. How is cheese made in Lombardy ?

A. From ewes' and goats' milk, mixed with that of the cow. It has a very rich flavour, from the pasture on which the animals feed ; and is called Parmesan cheese.

Q. What is parchment ?

A. The skin of sheep and goats. Sheep are most useful animals ; their wool, which is shorn twice a-year, is spun, woven, and dyed to make cloth for coats, flannel and stockings for winter.

Q. Is the flesh of the goat eaten for food ?

A. Not in England, but the hair is very useful ; when mixed with wool it makes a kind of cloth called felt, of which hats are made.

Q. Is not the fur of the rabbit and hare used in the same manner ?

A. Yes ; the skin of goats is also used to make leather, called Morocco leather, because it was invented by the people of Morocco in Africa.

Q. Is not Morocco leather coloured?

A. Yes; and the skin of the goat is used because from its softness it takes the dye better, and the colours are more brilliant. Morocco leather is now beautifully made in London.

Q. What is a young goat called?

A. A kid. Gloves and sometimes shoes are made of the skin of the kid, and also of the lamb and doe skin. The doe is the female deer.

Q. Are the horns of the deer useful?

A. Yes; in ancient times harts-horn was made only from them; but it is now also distilled from bones. The flesh of deer is called venison.

Q. Of what use are swine?

A. Their flesh supplies us with pork, ham, and bacon; their fat, after being melted and separated from the flesh, forms lard, while their skin is made into leather for saddles and bridles.

Q. Is dog's skin useful?

A. Yes; shoes are made of it; men's shoes are partly made of calves' skin.

Q. Is the ass useful ?

A. It is the horse of the poor man ; its milk is considered very salutary for sick persons ; leather is also made of its skin.

Q. Mention the names of some foreign quadrupeds whose skins are useful.

A. The merino sheep, the Angora goat, the elk, the bear, the badger, the wolf, the wild cat, the lynx, the tiger, the leopard, and the wild fox.

Q. Of what country is the merino sheep a native ?

A. Of Spain. The Angora goat is a native of Thibet. Cashmere and mohair are the wool of goats found in the northern parts of India. The wool of these goats is spun into very fine cloth for dresses, shawls, &c.

Q. What is the elk ?

A. A kind of deer as large as a horse ; gloves are made of its skin ; it inhabits Europe, Asia, and America.

Q. Of what countries is the bear a native ?

A. Of most northern countries.

The fur is useful for hammer-cloths for carriages, caps, and gloves, and to line winter cloaks. Muffs, &c., are seldom now made of this fur; bear-skins are black and brown, except in Greenland, where the bears are white.

Q. What is the badger?

A. A small kind of bear; the skin is used for soldiers' knapsacks and for travelling trunks; the hair or bristles are made into brushes for painters, and are used by shoemakers instead of needles.

Q. Of what are the brushes used by artists made?

A. Of camels' hair fixed in quills. The hair of the camel falls off, and is renewed every year.

Q. Of what are the beautiful Indian shawls made?

A. Of camels' hair; imitations of it, made from undressed wool, are now used for ladies' cloaks and trimmings.

Q. Is the skin of the wolf useful?

A. Yes; it makes a warm and durable fur. Wolves were once very numerous in England, but were de-

stroyed by order of King Edgar and Edward I.

Q. What is the colour of the hair of the wild cat?

A. A fine whitish-grey. This cat is very savage, and inhabits the woods of Asia, America, and some parts of Europe.

Q. What cat's skin is most valuable?

A. That of the Spanish cat. The Russians also export a great number of cats' furs even into China.

Q. What is the lynx?

A. A creature of the cat tribe, about four times as large, with a soft thick spotted fur.

Q. What animals provide us with fur for muffs, boas, victorines, and other fur trimmings?

A. The best furs are from the sable, the ermine, the chinchilla, the Siberian squirrel, the polecat, and sometimes the bear.

Q. What is the sable?

A. An animal about the size of a large rat, found in the northern parts

of Asia and America. The fur is a dark brown with black edges. It is very expensive.

Q. What is the ermine?

A. A little creature about the same size as the sable, found in Siberia, Russia, Norway, and Lapland. The ermine is yellow in summer and white in winter, with a black tail.

Q. What is the colour of the fur of the Siberian squirrel?

A. A kind of grey. There are red, white, and black squirrels in other countries, but the skin of the grey or Siberian squirrel is the most valuable.

Q. What is the chinchilla?

A. A small creature of the rat tribe. The fur is a mixture of grey and white, and beautifully soft. It is found in South America. The Peruvians used to spin the hair into wool.

Q. What is the fur of the polecat called?

A. Fitch. It is said to breed moths, and is now seldom used for dress. Polecats are natives of Germany and Poland.

Q. Have not many other skins been dyed to make imitations of these valuable furs?

A. Yes; the skins of the squirrel, hare, rabbit, and cat, are often dyed to represent sable.

Q. Are the skins of wild beasts ever used?

A. Yes; the skins of the tiger and leopard are used to place under saddles on war-horses, also for hammer-cloths and hearth-rugs. The Chinese value tiger-skins very highly.

Q. What are seals?

A. Amphibious animals, generally found in rocks and caverns near the Polar Seas. Their skin is very useful for covering trunks, making caps, &c.

Q. What are elephants' tusks?

A. Ivory: that of Ceylon is not so liable to become yellow in wearing, and hence is preferred to that of Guinea.

Q. Of what use is ivory?

A. For manufacturing various articles; handles for knives and piano keys are made of it, as well as boxes, fans, and other ornamental articles.

Q. Is ivory valuable?

A. Yes; the Indians and Chinese can make from a piece of ivory weighing about 3 oz., a beautiful toy worth 100 dollars, or nearly £25.

Q. What is ivory-black?

A. Animal charcoal, being a powder prepared by heating ivory shavings in an iron cylinder. It is used by painters and jewellers.

Q. What is often used for common purposes instead of ivory?

A. Bone. The bones of animals may be scraped and polished to make handles, and many other useful things; the shavings of bones are also useful.

Q. Is the skin of the rhinoceros thick?

A. Yes; it is sometimes an inch thick, and so hard and pliant, that walking-sticks and riding-whips are made of it.

Q. Is the skin of the wild-boar useful?

A. Not very, as it is thick and coarse; but the flesh, when pickled, is called brawn; and the hams brought

from Westphalia, in Germany, have a very peculiar flavour, being smoked in chimneys where wood only is burnt.

Q. What is the marten?

A. A small animal found in Hudson's Bay; the fur is much admired by the Turks. It is of a dark colour.

Q. What is shagreen?

A. The skin of the wild ass, useful from its hardness for many things,—covers of books, cases, leaves for pocket-books, &c., are made of it.

Q. What is musk?

A. A perfume, found in a bag under the stomach of the musk-deer. It is an odoriferous substance, one of the most powerful, penetrating, and lasting of all perfumes. It is used as a medicine.

Q. What is the chamois, and where is it hunted?

A. A kind of antelope, whose skin is in much request: this animal is hunted in the Alps and Pyrenees.

Q. What kind of animal is the beaver?

A. An amphibious animal about the

size of a rabbit, of a brown colour, and a native of Canada and other parts of North America; beaver hats are made of the hair.

Q. For what is it remarkable?

A. For its wonderful instinct, and for the curious manner in which it contrives its habitation.

Q. Are the sinews of animals useful?

A. Yes; when boiled down they make glue. A kind of glue, called size, is also made from the parings of sheep-skins and the edges of parchment.

Q. Of what are the strings of harps and violins made?

A. Of the entrails of sheep and lambs twisted; it is called cat-gut.

Q. What is sponge?

A. A porous marine substance found adhering to rocks and shells; it is supposed to be of animal origin, and is used for various purposes in the arts and surgery, besides being an indispensable requisite for the bath.

Section 2.—Birds.

Q. Which birds are called domestic fowl in England ?

A. Turkeys, geese, ducks, and chickens, all of which are eaten for food.

Q. Of what other use is the goose ?

A. The small feathers of the goose are used for stuffing beds, the wing feathers for pens, and the soft feathers on the breast are called down. Chickens' and ducks' feathers are also used for filling beds.

Q. Is not the swan a domestic bird ?

A. Yes, but the swan is not now eaten; it is kept for ornament, as also the peacock. Cygnets, or young swans, are sometimes fattened for the table.

Q. What is swan's-down ?

A. The skin of the wild swan dressed with the down on it, and made into muffs and boas for ladies.

Q. Are not the young pea-fowl considered great delicacies ?

A. Yes; and among the ancient Romans the peacock was also highly

esteemed as a valuable dish. The Chinese decorate the caps of their mandarins, and their ornamental works, with peacocks' feathers.

Q. What are wild birds generally called when used for food ?

A. Game; such as pheasants, partridges, wild pigeons, &c.

Q. Is the plumage of birds in eastern climates more beautiful than that of those of Europe ?

A. Yes; the colours are generally brighter and gayer. The most beautiful is that of the bird of paradise, found in New Guinea, and sometimes worn by English ladies in their bonnets.

Q. What are those large feathers sometimes worn by ladies ?

A. The feathers of the ostrich, a large African bird. The eggs of the ostrich are much esteemed; they are so large that one will weigh fifteen pounds, and furnish food enough for eight men.

Q. Have the feathers of birds been generally used for ornaments ?

A. Yes; and among savage nations

the chief is generally known by wearing the feathers of some particular bird.

Q. What is eider-down ?

A. The beautiful down of the eider duck. These birds strip the down from their breasts to line their nests, from which it is stolen by the natives.

Q. Where are they found ?

A. In the northern parts of Europe, Asia, and America. Cushions and pillows are made of the down, and in very cold countries beds of it are used instead of quilts.

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*Section 3.—Insects.**

Q. Can any insects be useful to man ?

A. Yes; that interesting little insect, the bee, provides us with honey and wax.

Q. What refreshing drink is made from honey ?

A. Mead and metheglin. The cells in the beehive, which contain the

* See also O'Brien's Simple Catechism of the Animal, Vegetable, and Mineral Kingdoms, page 32.

honey, are formed of wax, and are called the honeycomb.

Q. Of what use is wax?

A. For making wax-candles, forming moulds, and many other things: the bee's-wax is yellow, like honey, but is made white by melting in water and bleaching in the sun.

Q. Of what is sealing-wax made?

A. Of gum lacca, melted and prepared with resin, and coloured red with ground cinnabar, vermilion, or according to fancy.

Q. What is gum lacca?

A. It is a resinous incrustation produced on the boughs of trees by the punctures of an insect called the *coccus lacca;* it forms the basis of dyes, varnishes, and sealing-wax.

Q. What is the colour of this gum?

A. A bright red: it is formed in cells like the honeycomb, in which, when broken, the young insects are found; they are of a bright red colour.

Q. What are nut-galls?

A. A kind of spherical excrescence formed upon the leaves and leaf-stalks

of several species of the oak and tamarisk in the south of Europe. They are made by the punctures of the female gall-fly.

Q. Are the nut-galls, used for dyeing, &c., produced in England ?

A. No; it is from Aleppo, in Asiatic Turkey, that the most useful nut-galls are exported in great quantities; the black and green are used to dye black, and also in making ink.

Q. What are cantharides ?

A. Spanish flies, or beetles, used for raising blisters. They are produced from a little worm hatched on wheat, and are all of a green or golden hue. They are destroyed by the fumes of boiling vinegar, and afterwards dried.

Q. What is cochineal ?

A. A dye produced from an insect of the same name, found in the leaf of a tree growing in Mexico and the Spanish West Indies.

Q. Do these little red insects alone produce this beautiful scarlet ?

A. No; they are prepared with a

solution of tin. These insects are not larger than a pea.

Q. What is the hornet?

A. An insect of the wasp species. It is much larger and stronger than the wasp, and its sting gives severe pain: hornets are much esteemed by the Hottentots, who boil them in milk, and make their eggs into a kind of soup.

Q. What is coral?

A. A beautiful substance formed by small creatures, called polypes, into large rocks. The real, or red coral, is found in the Red Sea and the coasts of the Mediterranean. The white is found on the shores of Ceylon.

Q. Which is the most useful insect for clothing?

A. The silkworm. Velvet, satin, and silk are made of the web. It is a native of Serica, a country of Asia, generally supposed to be China.

Q. What changes does the silk-worm undergo?

A. From a little black egg, of the size of a pin's head, a worm is hatched; and, after feeding on mulberry-leaves

for about six weeks, it becomes a large yellowish worm or caterpillar.

Q. What happens to it then?

A. It winds itself up in a bag of silk, from which, if the silk were not wound off in a month, it would work its way out and appear as a beautiful moth with four wings.

Q. What is the bag of silk called?

A. A cocoon; when wound off at the end of a fortnight, a grub or chrysalis is found within, which remains another fortnight before it becomes a butterfly.

Q. Does the silkworm eat after it begins to spin?

A. No; and the butterfly, after laying about two hundred eggs, dies in a week.

Q. What are leeches?

A. Black worm-like animals, found in muddy waters in several English rivers; useful in surgery for drawing blood.

Q. How are they caught?

A. In many ways, but the best is by throwing bundles of weeds into the

water, and when drawn out the leeches will be found sticking to them. These creatures have three small sharp teeth with which they bite.

Section 4.—*Fishes.**

Q. Are any of the fishy tribes useful in manufactures, &c.?

A. Yes; the whale, the tortoise, the sturgeon, and the oyster.

Q. Where is the whale found?

A. Principally near the shores of Greenland. The small bones of the roof of the mouth are useful for many things, and are called whalebone. There are about four or five hundred pieces in one whale, each measuring three or four yards long.

Q. What is done with the fat of whales?

A. It is melted, and called train-oil; the Greenlanders call it blubber: it is twelve inches beneath the skin, and the oil obtained from it is used for lamps, cleansing wool, &c.

* See also O'Brien's Simple Catechism of the Animal, Vegetable, and Mineral Kingdoms, page 28.

Q. What is spermaceti ?

A. An oil prepared from the cachelot whale, of great use in medicinal cases; candles are also made of it. The cachelot whale is known by having a hunch on its back.

Q. What kind of creature is the tortoise ?

A. There are two kinds, the land and the sea tortoise. It is a sea tortoise, called a caret, that furnishes the beautiful shell so useful in England.

Q. Where is it found ?

A. In the islands of the Indian Ocean. They are said to be so large on the coast of Brazil, that the natives make boats of the shell. Combs, boxes, and other things, are made of tortoise-shell in England.

Q. What is a turtle ?

A. A kind of tortoise found in most countries within the torrid zone, very valuable for making soup.

Q. What is caviar ?

A. A kind of food eaten by the Russians and Italians, made from the roes of the sturgeon, a large fish, sometimes

twenty feet long. The greatest sturgeon fishery is at the mouth of the Wolga.

Q. What other useful article is procured from the sturgeon?

A. Isinglass, which is an animal jelly obtained from the swimming-bladder of various fish. It is employed both in the arts and domestic economy, being used in confectionary and cooking, and for clarifying wine and beer.

Q. What is valuable in the oyster besides the food it provides for us?

A. The oyster found in the Persian Gulf and off the coast of Ceylon produces the pearl, which is a disease owing to some injury done to the shell. These oysters lie at the bottom of the sea, and are obtained by diving.

Q. How are the pearls separated from the oysters?

A. By placing them in heaps of sand, which causes the fish to decay, and the pearls to separate from the decayed flesh.

Q. How many will one oyster contain?

A. Generally about twelve or four-

teen, but it is said that one oyster has produced one hundred pearls.

Q. What is mother-of-pearl ?

A. It is the hard, silvery, and brilliant layer of several kind of shells, particularly oysters, which is often variegated with changing purple and azure colours. The large oysters of the Indian Seas alone secrete this coat of sufficient thickness to render their shells available for the purposes of manufacture.

Q. Are these oysters larger than those we have in England ?

A. Yes; the pearl oyster is four times as large; and the flesh is equally good when pearls are found in it as when they are not.

Q. What are anchovies ?

A. Small fish found in the Mediterranean, and along the coasts of Spain, Portugal, and France; it is about the size of a sprat, much used for sauce, and also pickled.

Q. What is the nautilus ?

A. A species of mollusca. Its name has been erroneously applied to other

species. The animal which is said to sail in its shell upon the surface of the water is the Argonauta Argo, and very different from the nautilus, and it is this shell which is supposed to have given mankind the first idea of a sailing vessel.

Q. What is the murex, or purple fish?

A. A kind of shell-fish, from which it is supposed the Egyptians obtained the rich purple dye so much valued by the ancients.

Q. What is the cuttle-fish?

A. A fish which is furnished with a little bladder under the throat containing a dark inky fluid, of which it is supposed the Chinese partly make Indian ink, while its bones being crushed are employed in making pounce.

CHAPTER V.

GEOLOGY, MINERALOGY, CHEMISTRY, ETC.

Section 1.

Q. What is meant by geology?

A. A description of the structure of the globe, the relative situation of

rocks and minerals, and their connection with each other.

Q. From what is the word geology derived ?

A. From two Greek words: *ge*, the earth, and *logos*, a word or discourse.

Q. How may geology be divided ?

A. Into four divisions.

Q. What is the first division of geology ?

A. A knowledge of the materials which form rocks, mountains, and strata.

Q. What are the strata ?

A. The different beds of earth which lie one under the other below the surface.

Q. What is included under the second division ?

A. The direction, formation, and extent of the mineral dykes and metallic veins which pass through the earth.

Q. What is the third division ?

A. It includes the changes which occur on the surface of the earth by inundations, earthquakes, and volcanoes.

Q. What may the fourth division be termed ?

A. A kind of speculative geology, or an inquiry into the causes which may have formed mountains, or caused other changes on the earth's surface.

Q. Of what are rocks and mountains principally composed?

A. They have been divided by geologists into classes: 1. Primary rocks; 2. Intermediate rocks; 3. Secondary rocks; 4. Alluvial ground; 5. Volcanic products.

Q. What is meant by primary rocks?

A. Primary rocks are supposed to have been formed before the creation of vegetables and animals; they are extremely hard, and their substances are pure crystallized matter.

Q. What are intermediate rocks?

A. They consist partly of crystallized matter, and contain numerous remains of animals and vegetables in a fossil state. They separate the primary and secondary rocks, and partake of the nature of each.

Q. Do not these rocks contain metallic ores?

A. Yes; and also sandstone, coal, limestone, chalk, &c.

Q. What is alluvial ground?

A. Land formed from the ruins of other rocks by the influence of water; it consists of gravel, clay, &c.

Q. What are volcanic products?

A. Substances thrown up from volcanoes, or formed by subterranean fires.

Q. What number of primary rocks are observed in nature?

A. Eight. Among these are included granite, porphyry, and granular marble.

Q. Of what use is granite?

A. It is used for paving carriage-roads, on account of its hardness and durability. Waterloo and London Bridges are built of granite.

Q. Is it found in England?

A. Yes, in Cornwall; and forms the summit of some of the highest mountains in the world.

Q. Where are the principal quarries for porphyry?

A. In Egypt; it is the hardest granite, and of a red colour; it has

been used for statues and columns, as it will bear as high a polish as marble; but on account of its hardness, the work is expensive.

Q. What is granular marble?

A. All kinds of marble may be included under this term; there are about twenty different sorts, as very few countries produce the same.

Q. Which are considered the most beautiful?

A. The Parian marble, found in the Island of Paros, in the Grecian Archipelago; it is beautifully white, and most of the ancient Grecian statues were made of it.

Q. What European countries are famous for marble?

A. Italy, Spain, France, and Great Britain. The white-grained marble with grey and blue stains is brought from Carrara in Italy.

Q. How is white marble generally veined?

A. It is veined with blue, red, green, yellow, violet, according to the country in which it is found.

Q. Where is black marble found ?

A. It is found in some quarries of France and Italy. African marble is generally of a reddish-brown streaked with white, or of carnation with veins of green. In many places in Europe marble is of a pale red, yellow, and black, with veins of other colours.

Q. Where is the best English quarry for marble ?

A. In Derbyshire. There are also beautiful marbles found in Devonshire, Westmoreland, and many parts of Scotland.

Q. What is alabaster ?

A. A kind of limestone, sometimes supposed to be fine transparent marble, but it is of a closer texture, and belongs to the secondary rocks. It is much used for statuary and ornamental purposes. Most of the alabaster with which we are supplied comes from the shores of the Bristol Channel, between Watchet and Minehead.

Q. How many divisions may be said to belong to secondary rocks ?

A. Twelve: of these limestone,

bitumen or common coal, rock-salt, gypsum, and chalk, are most used.

Q. Of what colours are limestones?

A. Black, white, red, and yellow. Limestone is burnt in a kiln to make lime for mortar. Lime-water is also used as a medicine.

Q. Is not gypsum another kind of alabaster?

A. Yes; it is softer than limestone, and when calcined and powdered forms plaster of Paris. In the crushed state it is used as manure in North America. The images carried about for sale by Italians are formed of this material. It is found in Derbyshire and Cheshire, but the best comes from Italy.

Q. Is the common coal found in England?

A. Yes, England is the country most noted for coals; great quantities are exported to other nations. It is principally found near Newcastle-upon-Tyne, Sunderland, and Whitehaven.

Q. Where is cannel-coal found?

A. In Lancashire. It gives a brilliant light, and affords the best gas.

This coal can be polished, to form vases and other ornaments.

Q. Of what is the pavement of Lichfield Cathedral formed ?

A. Of pieces of cannel-coal and alabaster, to appear like the squares of a chess-board.

Q. What is coke ?

A. Sea-coal partly burnt. Mostly used where a great heat is required.

Q. Where is rock-salt found ?

A. Chiefly in Poland, Hungary, and Catalonia. Sea-salt is most likely produced by the quarries of rock-salt having been penetrated by sea-water, which carried away the saline particles with it.

Q. Is salt from rock and sea-water used with food ?

A. In some countries; but in England it is drawn from briny springs and wells. The best are in Cheshire, Worcestershire, Hampshire, Northumberland, and some other countries of Europe.

Q. Are there any remarkable mines of rock-salt ?

A. Yes; the Polish mines are wonderful both in size and depth. At the mine of Cracow, there is a kind of town under the earth; the miners live there entirely, and horses taken down never see daylight again. In these mines many persons have been born, have lived, and died.

Q. In what form is rock-salt found?

A. Hanging like icicles from the roof and sides of the mines. Travellers when they enter are astonished at the glittering appearance of the salt, which has been cut into columns, arches, and even chapels; and these being lighted with flambeaux, sparkle as if they were covered with thousands of precious stones.

Q. What is chalk?

A. It is a kind of earth forming part of the composition of secondary rocks; it is usually full of the remains of marine animals, and contains layers of flint.

Q. What is done with flints?

A. They are sometimes used for houses and walls, and are broken to

pieces to make roads; when burnt into powder they are mixed with clay to make china and glass.

Q. Is slate useful?

A. Yes, as it can be cut into thin plates for covering houses. Writing slates and slate-pencils are also made of this stone, when found solid and dark-coloured.

Q. Is not china made of a kind of earth?

A. Yes, called porcelain-clay, very fine and white, and hence the finest kinds of earthenware are called porcelain.

Q. When was the art of making porcelain first discovered?

A. It is not known, but the manufacture has been carried on in China at King-le-Ching since A.D. 442. It is first mentioned in Europe in 1531. It was made at Dresden in 1706, and in England by Wedgewood in 1762.

Q. What is the word porcelain derived from?

A. From *pour cent années*, it being believed that the materials of porce-

lain were matured underground a hundred years.

Q. From whence is Portland stone dug?

A. From some rocks named the Isle of Portland in Dorsetshire. It is called freestone because it will not split, and is therefore a fine stone for building.

Q. Which of the buildings of London are built of freestone?

A. Most of the bridges, St. Paul's Cathedral, the Monument, Whitehall, &c. It was introduced into general use by Sir Christopher Wren, after the fire of London.

Q. Of what use is chalk?

A. It is used for manure; and a chalky soil promotes the growth of corn and fattens cattle. It is also used as a medicine.

Q. Is not putty made from chalk?

A. Yes; whitening is pounded halk, which, when mixed with oil and white-lead, forms putty.

Q. By whom is black chalk used?

A. By artists. It is found in France,

Spain, and Italy. From the latter place we have the best Italian chalk.

Q. What is the foundation of all other rocks?

A. Granite; and from its great depth it is seldom met with. Countries covered with secondary rocks can generally be cultivated over the whole surface.

Q. Of what are soils composed?

A. Of various kinds of earth, produced by the influence of air and water, on all kinds of rocks lying near the surface.

Q. Is any thing useful in a decayed state?

A. Yes; rich soils are produced by the remains of animals and vegetables in a state of decomposition. Secondary rocks also contain great quantities of these in their formation; but from the absence of air and the influence of saline particles to act upon them, they are sometimes found in a state of petrifaction.

Q. What is petrifaction?

A. Changing to rock or stone. The

organic remains of animals in a perfect form have been dug out of rocks, and are preserved in museums; they are called fossil remains.

Q. Are there any places in England which produce petrifactions ?

A. Yes; the caverns of Derbyshire and Westmoreland. They contain water strongly impregnated or filled with mineral juices, and which, as it drops, not only becomes stone itself, but petrifies every thing upon which it falls.

Q. Of what are volcanic rocks formed ?

A. Of lava, pumice-stone, and other things, which have been thrown up by the fires of a volcano; the soil produced by these particles is so rich, that although whole cities have been buried by the burning lava, yet after a few years another is found near its ruins.

Q. What city is near the foot of Mount Vesuvius ?

A. Naples. Many curious things are made by the Italians of the lava; and pumice-stone is used for smoothing the

surface of wood, leather, metals, stones, glass, and other things; it is, therefore, very valuable in trade. The dome of the church or mosque of St. Sophia at Constantinople is built of pumice-stone, for the sake of its lightness

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*Section 2.—Mineralogy.**

Q. What are meant by the mineral productions of the earth?

A. Any thing dug out of the earth in mines. Minerals may be divided into four classes:—1st, Earthy, or the stones; 2nd, Saline, or the salts; 3rd, Inflammable, as sulphurs; 4th, Metals, or metallic ores.

Q. How are the earthy minerals divided?

A. Into the siliceous or flint genus, and the clay genus?

Q. What is included under the flint genus?

A. All marbles, stones, flints, and precious stones. The clay genus in-

*See also O'Brien's Simple Catechism of the Animal, Vegetable, and Mineral Kingdoms, page 60.

cludes common clay, sand, gravel, or other moist earths.

Q. What are the saline or salt minerals ?

A. They contain a mixture of acids with alkali, as saltpetre, nitrate of potash, common salt, sal ammoniac, &c.

Q. What is alkali, or kali ?

A. A kind of salt, sometimes called soda, found in a burnt vegetable of that name. Potashes are the ashes of other vegetables.

Q. Where is saltpetre found ?

A. It is a kind of salt, found on the surface of the earth in Africa, India, and some parts of the South of Europe. It is sometimes called nitre.

Q. What is nitrate of potash ?

A. A mixture of nitre and potashes. These earths are all found mixed or combined; but the same can be produced by chemistry.

Q. What are acids ?

A. Chemical preparations of a sharp and sour taste. They all belong to the class salts, and by mixing with alkali produce many useful minerals

Q. What are the inflammable minerals?

A. They include sulphur, resins, bitumens, graphite, and all combustible bodies except metals and the diamond.

Q. What is included under minerals of the fourth class?

A. All substances composed, either partly or entirely, of metals.

Q. What are the principal precious stones included under the first class of minerals?

A. The diamond, the ruby, the emerald, the topaz, the garnet, the sapphire, the amethyst, the beryl, the carbuncle, the cornelian, the chrysoprase, opals, the turquoise, &c.

Q. Where are diamonds found?

A. The best in the mines of Golconda in India. The diamond is a sparkling white; very precious as an ornament in dress; and, from its hardness, is used to cut glass. It was called by the ancients, adamant.

Q. Where is the ruby found?

A. In Pegu and Ceylon. Rubies are also found in Europe, particularly in

Bohemia and Hungary. It is a red sparkling gem, of the first class among precious stones.

Q. Of what colour is the emerald?

A. Of a dark but delicate green. It is brought from the East Indies; some are said to be found in Cyprus, and even in our own islands.

Q. Is the topaz a valuable stone?

A. No; it is the third order of gems after the diamond; it is generally yellow, but some have been found pink, orange, and blue. The finest come from South America, and many parts of Europe.

Q. What is the garnet?

A. A fine stone of a deep crimson colour. There are mines of this gem in Bohemia.

Q. Where is the rich purple amethyst found?

A. In most eastern nations; but the common amethyst, brought from South America, is of a pale violet. It was a favourite gem with the ancients, who supposed that, when hung round their

necks, it would prevent their being inebriated.

Q. Of what colour is the sapphire ?

A. Of a fine blue; found principally among the sands of the rivers in Ceylon.

Q. Are not the beryl and chrysoprase both green ?

A. Yes; but the beryl is a sea-green, and the chrysoprase a delicate apple-green; it is brought from Germany, and the beryl from the borders of China.

Q. What is cornelian ?

A. A stone useful for seals, necklaces, &c.; sometimes white and yellow, but usually a pale red. It is found in most countries, but the best are from India.

Q. What is the opal?

A. A precious stone, of which there are mines in Turkey, Arabia, Egypt, Bohemia, and Hungary; the opal is half-transparent, and has the colours of the rainbow more or less lively, and changeable according to the different

positions of the stone relatively to the light.

Q. What is turquoise?

A. A soft stone, of a pale blue colour, found in the mines of Persia. The Persians and Turks consider them very valuable as ornaments. They are brought to England from Russia.

Q. What is jasper?

A. It is a very hard stone, with stripes and shades of different colours with black dots; used for ornamental purposes; also for pillars in large buildings. There are fine quarries in Spain.

Q. What is lapis lazuli?

A. A beautiful dark stone, with dots like golden veins; chiefly found in Asia.

Q. What is ultramarine?

A. A preparation made from the lapis lazuli. It is a beautiful blue, and very useful to artists for oil and water-colour drawings.

Q. Of what use is common soot?

A. The colour called bistre, used by artists, painters, and dyers, is made from it; and it is also used as a manure.

Q. What is lamp-black?

A. The carbon or smoke formed by burning vegetable substances in confined air. It is used in lithographic and printing inks.

Q. What is ochre?

A. A kind of yellow earth found in iron, copper, and lead mines; much used by artists for painting.

Q. What useful things are included in the second class of minerals?

A. The principal are the two sorts of alkali. Soda and kali form a mixture, of which, with acids and other minerals, by a chemical process, many useful drugs may be produced.

Q. What are Epsom salts?

A. The popular name for sulphate of magnesia, a well-known purgative. Seidlitz salts or powders are brought from Bohemia.

Q. What is alum?

A. A kind of salt dug from the earth, containing sometimes sulphur and clay; it is useful in manufactures, in dyeing, tanning, preparing paints, in making paper, refining wine, whitening bread, and hardening candles.

Q. By whom was it introduced into England?

A. By Sir Thomas Chaloner, in 1608; who discovered that the mineral he found while in Italy, was the same as one on his own estate in England.

Q. How is bay-salt made?

A. By exposure to the sun's rays. It is principally in France that bay-salt is made. It is of a brown colour; hence its name.*

Q. Is not vitriol a mineral salt?

A. Yes; and it is found in European countries. The Roman vitriol is blue; that of Sweden and Germany, greenish; there is also a white kind.

Q. What is borax?

A. A mineral salt used in medicine, also for soldering gold and silver.

Q. What is the asbestos?

A. A saline mineral, like a silvery white stone. The filaments or silky threads were made into a kind of cloth among the ancients in which to burn their dead.

* See Erredge's Student's Handbook of General Information, page 15.

Q. On what account ?

A. Because, being itself incombustible, and only becoming white by the heat, the ashes of the dead person were more easily collected. This mineral was also called amianthus.

Q. What is umber ?

A. A kind of earth from which a dark colour, used by painters, is made.

Q. What is included under the third class of minerals ?

A. Sulphur, resins, mineral pitch, graphites, and all kinds of coal.

Q. What is sulphur ?

A. A hard mineral of a yellowish colour, used in medicinal cases; and when mixed with saltpetre and charcoal, makes gunpowder.

Q. Who discovered the use of gunpowder?

A. Roger Bacon, a monk; but a monk of Cologne, named Swartz, had already found that these three ingredients would cause explosion.*

Q. What is amber?

* See Erredge's Students' Handbook of General Information, page 5.

A. A beautiful yellow resin, found in the mines of Prussia and on the coasts of the Baltic and Adriatic; very useful in medicine, and sometimes for ornaments. Some suppose it to be honey converted into bitumen. Pieces very frequently are found containing flies and other insects of extinct species. When rubbed it becomes electrical.

Q. Is amber all one colour?

A. No; there is the white, the yellow, and the black. The white is most useful in medicine; the yellow and black for beads and ornaments.

Q. What is black amber generally called?

A. Jet. It is light, smooth, and pitchy, and formed in the earth like coal.

Q. What is ambergris?

A. An odoriferous substance obtained from the sperm whale, valued as a perfume and a stimulant aromatic. In the east it is used in cookery.

Q. What are graphites?

A. Minerals containing iron; one of which is plumbago, or black-lead,

used for pencils. The best mines for this are in Cumberland.

Q. Where is arsenic found?

A. Mostly in copper mines. The white arsenic is a fierce poison; red arsenic is made by mixing white arsenic with sulphur. Yellow, red, and green arsenic are used by oil and water-colour painters, also by dyers.

Q. Is not verditer used by artists?

A. Yes; it is a mineral used sometimes for a blue, but more frequently mixed with yellow, for green. Most colours used by painters and dyers are prepared from coloured earths, minerals, or plants.

Q. Where is the calamine stone found?

A. Plentifully in Germany, the Netherlands, and England. It is burnt and ground in a mill.

Q. What is smalt?

A. A kind of mineral stone, prepared and purified abroad, and brought to this country, sometimes as a blue powder, and sometimes in lumps.

Q. From what is it produced?

A. From cobalt, a mineral, containing a little silver, some copper, and a great deal of arsenic. Smalt is used with starch, and is known as powder-blue. Colours for artists, dyers, and painters are made from smalt and cobalt. There are mines of cobalt in Saxony.

Q. What is included under the fourth class of minerals?

A. Minerals from which metals are extracted. They are subdivided according as they agree or differ in shape, quality, colour, hardness, &c.

Q. How are metals found?

A. They are seldom found in a native state, except gold, silver, platina, and copper; but combined with sulphur, acids, or in the state of oxides.

Q. What has arisen from this combination?

A. The four genera of metals called ores: the alloys, the sulphurets, the oxides, and the salts.

Q. Of what do these genera consist?

A. The alloys consist of pure and impure metal in one ore; the sul-

phurets, of metal and sulphur; the oxides, of oxygen and metal; and the salts, of a mixture of metals and acids.

Q. Are not certain metallic ores found in particular rocks?

A. Yes, brimstone is found in granite, and in some kinds of slate, but never in limestone; certain ores are also found together, as lead with zinc, and copper with lead and iron.

Q. Where are gold and silver found?

A. In primary rocks, with porphyry and sandstone. Gold has been sometimes found in coal, also among the sands of rivers; iron is found in every kind of rock.

Q. How many principal metals are at present known?

A. Twenty-eight; twelve malleable, and sixteen not sufficiently tenacious to bear extension by beating.

Q. Which are the malleable metals?

A. Platina, gold, silver, mercury, copper, iron, tin, lead, nickel, palladium, cadmium and zinc.

Q. What is meant by malleable?

A. Any thing that can be bent, beaten, or stretched out, without breaking, is malleable. Gold is the most malleable of all metals; and being almost the heaviest, is therefore the most valuable.

Q. What country has always been famous for gold ?

A. Africa; but the quantity of gold now sold in England is brought from Peru and Chili in South America. The principal gold mines of Europe are in Hungary and Spain. Gold has also been lately found in large quantities in California, a peninsula of North America; and, more recently, in Australia.

Q. Where is silver found ?

A. Silver is a white shining metal found in all parts of the world, but the silver mines of Peru are by far the richest. Gold, silver, and platinum are called perfect metals, because they lose nothing by the heat of the fire.

Q. What is platinum ?

A. The heaviest of all metals, and harder than gold or silver. Its name

originated with the Spaniards on account of its silvery colour. It was found in the auriferous sands of the river Plata in South America. It was unknown in Europe until A.D., 741. It would be very valuable and useful could it be found in sufficient quantity, as its qualities are equal to those of gold and silver.

Q. Why are all metals besides gold and silver called imperfect ?

A. Because they can be melted or turned into powder by the heat of fire and dissolved or rusted by acids.

Q. Where is quicksilver found ?

A. In Germany, Hungary, Spain, Italy, and South America. Quicksilver, or mercury, is an imperfect metal, resembling melted silver; it is useful for many things, but chiefly for separating other metals from their ores.

Q. Have not the changes of the atmosphere great effect upon mercury?

A. Yes; and on this account mercury is used in barometers and thermometers, for in hot weather it rises, and in cold weather it sinks, and the

degrees of heat and cold, humidity and dryness, can thus be ascertained. Mercury is very useful in medicine; calomel is made from it.

Q. Where is copper found?

A. In all parts of the world; the best is from the mines of Sweden, and Paris mountain in the isle of Anglesea. Copper is of a reddish colour.

Q. How many kinds of copper are there?

A. Three; common, rose-copper, and virgin-copper. When copper is mixed with a large quantity of tin, it makes bell-metal, of which bells, stew-pans, &c., are made.

Q. What is bronze?

A. A mixed metal, being composed of two parts brass and one of copper. The Greeks added one-fifteenth of lead and silver. Bronze is used for statues; and in olden times the ancients wore bronze armour. Copper mixed with zinc makes pinchbeck.

Q. Of what colour is pinchbeck?

A. Nearly the same as gold; it is used for watch-cases, and other things.

Q. What is verdigris ?

A. A green rust sometimes found on copper, very poisonous, but used by dyers for dyeing black, and when mixed with logwood it makes a beautiful green for painting.

Q. Which is the most useful metal?

A. Iron; it is found in all parts of the world; the best iron mines of England are in Colebrook Dale, in Shropshire, and the forest of Dean, in Gloucestershire.

Q. How many kinds of iron are there ?

A. Three: cast-iron, forged-iron, and steel. Cast-iron is iron melted in a very hot furnace, and poured or cast, while liquid, into shapes made of earth, such as cannons, pipes, grates, &c.

Q. What is forging iron ?

A. Beating it while red-hot with large hammers into the shapes required, as horse-shoes, &c.; it is sometimes called wrought-iron.

Q. What is steel ?

A. It is formed by heating bars of iron with charcoal ashes and bone

shavings, to render it whiter, closer grained, and capable of bearing a very high polish.

Q. How is steel made hard or brittle?

A. By being thrown into cold water when quite hot. Steel is very useful on this account for all kinds of cutlery, because it can receive a sharp edge or point, as a razor, or a needle.

Q. What is emery?

A. A kind of heavy iron ore found with other minerals, and which, when ground to powder, is very useful for smoothing precious stones, cutlery, glass, &c.

Q. Where is the loadstone found, and what are its properties?

A. In iron mines in Germany, England, Arabia, Bengal, and China; it will attract any other piece of iron or steel placed near it. Every magnet has two poles, one pointing north, the other south, which causes its great use in navigation.

Q. What is tin?

A. The lightest of all the metals; it

is of a whitish colour, and being free from rust, it is very useful for cooking-vessels. Block tin is formed by pouring melted tin into stone moulds, shaped like saucepans, kettles, &c. &c.

Q. What English county is famous for tin?

A. Cornwall. The Phœnicians traded to this country for tin 700 years before Christ, and it is supposed the name of Britain, given to the island, is derived from this circumstance.

Q. Where are the best lead mines?

A. In England; the most important are in Cornwall, Devonshire, Northumberland, Durham, and some parts of Wales. Lead is a soft metal, but very heavy.

Q. For what is it used?

A. For covering houses, making pipes, cisterns, &c.; and when mixed with tin it makes pewter.

Q. What is white-lead?

A. Common lead corroded by the steam of hot vinegar; it is used by house-painters to thicken and dry their paints. White-lead is a slow poison;

the smell of a newly-painted house is therefore very injurious.

Q. Is not a preparation of lead used by artists?

A. Yes; it is called red-lead, and is used also by potters and surgeons.

Q. What is vermilion?

A. A beautiful red, prepared from mercury.

Q. What is zinc?

A. A brilliant white metal, very useful for manufactures, as it mixes well with most other metals.

Q. What is meant by alloys?

A. Alloys are portions of inferior metals, mixed with superior ones, such as copper with gold to render it harder, &c.

Q. Which are the fusible metals?

A. Bismuth, antimony, tellurium, arsenic, and chromium. These are all fused easily.

Q. What is meant by fusible?

A. Any thing that can be melted by heat is fusible; all metals are fusible, but some not without violent heat, as gold, silver, iron, &c.

Q. What is bismuth?

A. A mineral sometimes found in silver but more commonly in tin mines; by some supposed to be tin in an imperfect state, and frequently called tin-glass. It is glossy, white, and shining, and very useful to chemists.

Q. What is antimony?

A. A mineral found in all mines, but chiefly in those of silver and lead; it is similar to black-lead, and very useful in medicine and surgery. Letters for printing are made of lead mixed with antimony.

Q. What is tripoli?

A. A kind of earth mixed with sulphur, used for polishing metals and stones; first brought from Tripoli in Africa.

Q. What is rottenstone?

A. An earth of the same description found in Derbyshire and Stafford.

Q. Of what are tobacco-pipes made?

A. Of a fine clay, called pipeclay, which is also used for yellow ware.

Q. Which are the most useful metals that are fused with difficulty?

A. Cobalt, manganese, and many others, chiefly useful to chemists and surgeons.

CHAPTER VI.

CHEMISTRY.

Q. WHAT is chemistry?

A. The science which relates to those operations by which the intimate nature of bodies is changed, or by which they acquire new properties.

Q. What was the opinion of the ancients as to the principles of chemistry?

A. That they consisted of four elements, earth, air, fire, and water.

Q. What have been the discoveries of modern chemists?

A. These four elements have been analyzed, and other elements, of which they are composed, have been discovered.

Q. What are these simple elements?

A. Oxygen, hydrogen, nitrogen, chlorine, carbon, sulphur, phosphorus, nine earths, and above thirty metals.

Q. Of what is the air we breathe composed?

A. Of oxygen and nitrogen; 100 parts of atmospheric air contain 22 parts of oxygen gas, and 78 of nitrogen. These elements are preserved in the form of gases by a state of motion.

Q. What is gas?

A. A kind of invisible fluid produced from many substances. The gas which is used to light our streets and dwellings is produced from carbon, or coals.

Q. Of what is water composed?

A. Of hydrogen and oxygen; the latter in the greatest quantity: 100 parts of water consist of 85 of oxygen and 15 of hydrogen; these are both produced from water by heat in the form of gases.

Q. What is chlorine?

A. A kind of acid gas of a yellowish-green colour, produced from many substances, but particularly from common salt.

Q. What is carbon?

A. It is the foundation of almost

all animal, vegetable, and solid substances. Charcoal is impure, and the diamond pure, carbon.

Q. What is phosphorus?

A. A simple substance extracted from the bones of animals while in a state of decay: it is extensively employed in the manufacture of Lucifer matches.

Q. Which are considered the active or universal elements of Nature?

A. Oxygen, nitrogen, hydrogen, and, perhaps, caloric and light.

Q. What are the nine earths discovered by chemists?

A. Alumine, barytes, glucine, lime, magnesia, silex, strontia, yttria, and zircon.

Q. Which of these are most important?

A. Alumine, lime, magnesia, and silex.

Q. What is alumine?

A. It is pure clay; it cannot be melted, but is rendered hard by heat, and from its readiness to absorb water and grease is of great use to fullers for

scouring and cleaning cloth; it is then called fullers'-earth.

Q. What is lime?

A. Lime is produced by burning chalk, marble, limestone, &c.; by the heat the carbonic acid gas is expelled, and the lime remains.

Q. What useful cement is made from lime?

A. Mortar; after the lime has been burnt, it is mixed with water, ashes, and sand, to cement bricks in building, and when dry it hardens. Lime is also used in tanning.

Q. How is magnesia found?

A. Generally combined with sulphur; it is a soft white earth, very useful in medicine. Epsom salts are formed by a union of magnesia with sulphuric acid.

Q. What is silex?

A. The principal composition of stones; it cannot be melted with any heat, but when combined with alkalies, as soda and potash, it forms glass.

Q. Which are the two fixed alkalies?

A. Soda or kali, and potash; there is also a volatile alkali called ammonia, obtained from animal substances.

Q. How are chemical combinations produced?

A. By caloric, or that power which produces heat.

Q. What are some of the terms used to express chemical operations?

A. Combinations, solutions, fusion, calcined, combustible, inflammable, and affinity.

Q. What are combinations?

A. The mixture of two or more substances. A solution is produced by dissolving a substance in water, and a fusion by melting it.

Q. What is calcined?

A. Any substance burnt or reduced to fine powder by heat is said to be calcined.

Q. What is meant by inflammable and combustible?

A. Those substances are inflammable and combustible which readily take fire when in contact with each other, or by the influence of caloric.

Q. What is meant by chemical affinity?

A. It is the power by which the minute particles of different kinds of substances are caused to combine and form a new body, possessing properties entirely different from any of its component parts.

Q. Which are the principal chemical combinations?

A. Acids and salts, produced by uniting oxygen with other substances.

Q. How many acids have been discovered?

A. Sixty-six principal ones, besides others of minor importance. All acids are compound bodies, and are sometimes divided into four classes; the three first of which are compounded with oxygen; the fourth class consists of those which, at least, according to modern chemists, have no oxygen; as, for example, sulphuretted hydrogen.

Q. Mention a few of the mineral acids.

A. Sulphuric acid, nitric, muriatic, carbonic, phosphoric, and the arsenic.

Q. How are these produced?

A. By oxygen with sulphur for sulphuric acid; with nitrogen, for nitric acid; and so on.

Q. What is muriatic acid?

A. Acid produced by a combination of oxygen and chlorine; when mixed with soda, it is called muriate of soda, and is the common salt of the table.

Q. Name some of the vegetable acids.

A. The oxalic, the tartaric, the camphoric, and the prussic.

Q. What is prussic or hydrocyanic acid prepared from?

A. From blood and other animal substances; and when united with iron, it forms the beautiful paint called prussian blue.

Q. Are acids combined with other substances?

A. Yes; to make salts, they are combined with alkalies, earths, and oxides, and form many thousand combinations.

Q. What is the chemical name for these salts?

A. Sulphates. Sulphuric acid is known as oil of vitriol.

Q. How may acids be distinguished from alkalies?

A. The greater part of acids excite a sour taste in the mouth, and most of them are very corrosive: they change vegetable blues into reds. Alkalies have an acrid taste, and will convert vegetable blues into greens, red to purple, and yellow to a reddish-brown.

Q. What is the process of combustion?

A. During the burning of any combustible body, the oxygen from the atmosphere is absorbed by the influence of caloric, and a separation of the parts takes place.

Q. What are oxides?

A. The combination of oxygen with metals when exposed to heat, and in a less quantity than for acids, produces a kind of rust on the metals called oxides.

Q. How are gases produced?

A. Gas is separated from the substance of which it is a part by fire.

Q. What are mineral waters?

A. Water containing oxygen and

nitrogen gases, or acids, alkalies, and neutral salts.

Q. How can these be discovered?

A. By introducing an infusion of violets; if the water contains acids they will turn green; if alkalies, red.

Q. How may sulphur and bitumen be detected?

A. By the smell or taste; iron will tinge the water blue if a mixture of prussic acid and potash is introduced.

Q. How is copper detected?

A. It will deposit itself on a piece of bright iron put into the water. Arsenic in water will turn copper white.

Q. Which of the chemical combinations are inflammable?

A. Sulphur, carbon, hydrogen, and phosphorus, and all acids formed by a combination with oxygen.

Q. What are the uses of chemistry?

A. They are so numerous as almost to defy enumeration. Chemistry may with truth be said to be the handmaid of all the useful and of most of the elegant arts.

Q. What is aqua-fortis?

A. Aqua-fortis, or, as it is now called, *nitric acid*, is a mixture of clay and nitre, or saltpetre; all metals, except gold and silver, can be dissolved in it.

Q. Is it not used by dyers?

A. Yes; tin dissolved by it, and mixed with madder, makes a beautiful scarlet dye.

Q. What is copperas?

A. A salt formed from iron and sulphuric acid; it is of a bright green colour, and is used by dyers, tanners, and ink manufacturers.

Q. What other materials are used in ink?

A. Nut-galls and gum-arabic.

Q. What is white vitriol?

A. A mixture of sulphuric acid and zinc, much used in medicine, and by dyers and varnishers.

Q. What is alum?

A. A mineral salt, of great use in medicine, and in various manufactures of leather, paper, dyeing, &c.

Q. What is sal-volatile?

A. A volatile salt composed of sal-ammoniac and tartaric acid, and soften-

ed with spirits of wine; it is often scented, and very useful in medicine.

Q. Of what is tinfoil made, and what is its use?

A. Of a mixture of tin and quicksilver. When formed into thin sheets of metal it is used for lining tea-chests, boxes, &c.

Q. How is permanent marking-ink made?

A. By dissolving nitrate of silver in water with gum.

Q. What is caustic?

A. It is a substance made from silver dissolved in aqua-fortis, which forms a crystal, and is afterwards melted to form lunar caustic, so much used by surgeons for burning away proud flesh, &c., from wounds.

Q. What is crystallization?

A. It is the act or process by which the parts of a solid body, separated by the intervention of a fluid or by fusion, again unite and form a solid body. If the process be slow the particles assume a regular arrangement, but if rapid, the arrangement will then be irregular.

Q. What is the calx of lead?

A. The dross found on lead while melting. Red and white lead, so much used in paints, are the calces of lead.

Q. What is solder?

A. A cement made of two-thirds lead and one-third tin melted together, and much used by plumbers and tinmen.

Q. Of what is shot made?

A. Of lead mixed with arsenic, which makes it harder and more brittle.

Q. What is goulard?

A. A solution of acetate of lead, used as an external lotion or wash, and called after the name of its inventor, a Frenchman.

CHAPTER VII.

MANUFACTURES.

Section 1.—*Silk, Wool, Flax, etc.*

Q. WHAT is the origin of the word manufacture?

A. It is derived from two Latin words, *manus*, the hand, and *facturus*, about to make.

Q. What were originally the principal machines used in manufactories?

A. The distaff, the loom, and the mill-wheel; the distaff and loom were anciently worked by the hand, and the mill-wheel turned by wind or water, but now most machinery is worked by steam.

Q. Of what use are the distaff and loom?

A. The distaff for spinning, and the loom for weaving. Silk, cotton, wool, flax, and hemp, must all be spun and woven before being made into articles for use.

Q. Of what use are mills?

A. Mills turned by machinery, or by steam, are now used for spinning and reeling cotton, silk, and wool.

SILK.*

Q. What are the processes silk must undergo before it is woven into satin, velvet, or silk, for dresses, &c.?

* Diagram 296, 297, & 298; and cases 299, 301, 325, and 333. Division III. South Kensington Museum, will be found very interesting.

A. Spinning, reeling, bleaching, and dyeing.

Q. What is reeling?

A. The cocoons, or balls of silk spun by the silkworm, are thrown into warm water, and the ends of the threads being found, four or more of them are joined together and wound on reels; it is then called raw silk.

Q. Of what are satins and velvets made?

A. Of silk which has been wound from the cocoons while in boiling water.

Q. What is done next?

A. It is cleansed, and afterwards spun into threads of different qualities as required by the weaver.

Q. What is weaving?

A. A kind of fine matting. Threads the length of a piece of silk are stretched on a loom to a proper tightness; this is called the warp; the threads which cross are called the woof.

Q. How are these twisted with the others?

A. The long threads are separated by an instrument, called a reed, into

two sets, and by the working of a treadle, the two sets rise up and down alternately, and the cross threads are inserted between them.

Q. How is this effected?

A. By a little instrument, called the shuttle, which contains the woof, and is thrown across as the warp moves up and down.

Q. What is the colour of the silk when spun by the silkworm?

A. Silk when imported varies much in colour; the China and Brussa silk being of a pure white, while the Bengal is of different shades of straw colour. To produce the various colours it is first bleached and then dyed.

Q. What is the process of bleaching?

A. The silk is put into a thin linen bag, and boiled in soap and water for two or three hours; it is then thrown into cold water with a little indigo, and afterwards whitened with the fumes of sulphur, and then pressed.

Q. How are the patterns on ribbons and silk produced?

A. The threads of silk are first dyed,

and then woven into patterns designed by parties employed for that purpose.

Q. How is the pile on velvet produced ?

A. It is formed by the threads of the warp being placed over a kind of ruler or needle, in which is a channel or groove ; these threads are afterwards cut by drawing a sharp tool along the channel of the needle.

Q. By whom was silk first manufactured ?

A. By the Chinese, who appear to have known the art 2700 years B.C. Until the time of the Roman emperor Justinian, the silkworm* was cultivated only in China; but the raw material was purchased and manufactured by the inhabitants of Persia, Tyre, &c., for a long time before. Before the reign of Augustus the use of silk was little known in Europe.

Q. When was the manufacture of

* See O'Brien's Simple Catechism of the Animal, Vegetable, and Mineral Kingdoms, p. 32; and Erredge's Student's Hand-book of General Information, p. 131.

silk introduced into France and England?

A. Into the former country about the reign of Francis the First, 1521. It was brought into the latter in 1604, and was first manufactured by French refugees in 1688.

Q. Where are the largest silk manufactories established?

A. At Lyons, in the south of France.

Q. What place in England is noted for the weaving of ribbons?

A. Coventry, in Warwickshire.

WOOL.*

Q. Is not the process of preparing wool and flax something similar to silk?

A. Yes, in the weaving; but wool requires picking, dressing, and carding, before it can be spun or woven.

Q. What is done first to the raw wool?

A. It is picked and sorted; this is

* See Case 34, Division I., Section 1.—South Kensington Museum.

very necessary, as the same sheep will sometimes produce wool of different qualities.

Q. What is next done ?

A. It is cleansed and given to the wool-comber, who draws it through iron-spiked combs of different degrees of fineness; the fibres are thus drawn out smooth and straight for spinning and weaving.

Q. For what is wool used?

A. For every description of hosiery stuffs, carpets, flannels, blankets, and cloths.

Q. In what way does the weaving of carpets differ from that of cloth or silk ?

A. In the former case the warp is placed on the woof in an upright or perpendicular position ; in the latter it is laid horizontally.

Q. Whence have we the best carpets ?

A. From Persia and Turkey and Brussels; but Kidderminster, Wilton, and Axminster, in England, are also famous for this manufacture.

Q. How are the patterns formed on carpets?

A. From coloured patterns, which are divided into squares, in the same manner as those used by ladies for their Berlin wool-work.

Q. What causes Brussels carpets to look like rich velvet?

A. From the threads being passed over a wire, which is afterwards drawn out, leaving a row of loops.

Q. Are not Wilton carpets made in a similar manner?

A. Yes, but the loops are cut. Axminster carpets are woven without a seam, and are very expensive.

Q. What towns of England are famous for the manufacture of woollen goods?

A. Leeds and Norwich for woollen cloths, Witney for blankets, Wales for flannels, Nottingham and Lancashire for hosiery.

Q. Of what are the finest cloths made?

A. Of Spanish wool obtained from the Merino sheep.

Q. Is not England famous for the manufacture of woollen cloth?

A Yes; and formerly it was considered the staple commodity of the kingdom; for which reason, to mark its importance, the Lord Chancellor's seat in the House of Lords was, and still is, a woolsack.

Q. Are not wool and silk often mixed?

A. Yes; and form stuffs of different names, such as poplin, &c., &c., which are very often those of the original inventors, or of the places where they were first manufactured?

Q. What is meant by the scouring and fulling of cloth?

A. Oil and size having been used during the progress of spinning the cloth, potash is employed to get rid of the former, and soap and water to cleanse it from the latter; this is called scouring. Fulling is effected by enormous wooden hammers, which, by continually beating the cloth, increases its strength, by binding its filaments more closely together.

Q. Which is the next operation?

A. That of brushing or raising, which is effected by applying to the cloth the ripened head or fruit of the plant called the teazle,* which being made to revolve upon the cloth, the loose particles of it are raised and afterwards sheared or cut off. No instrument has yet been invented to supersede the teazle.

Q. How is flax prepared for spinning?

A. Flax requires more operations, both before and after weaving, than either wool or silk: when first gathered the stalks are left for the seeds to ripen, and are then tied in loose bundles, and left to steep in stagnant pools for about fifteen days.

Q. What follows?

A. A fermentation by which the bark or flaxy substance is separated; this is afterwards beaten and drawn through two combs, one with coarse teeth, the other with fine ones.

* A specimen of this plant may be seen at the South Kensington Museum, Division I., Section 1 B, Case 67.

Q. What is the next process?

A. It is spun into threads by machinery, and then woven into linen, lawn, cambric, sheeting, &c., &c.

Q. Is the process of bleaching fine linen very tedious?

A. Yes; it is several times steeped in hot and cold water, sometimes with soap and wood ashes, then laid on the grass, and kept wet.

Q. What is done after this?

A. It is washed in skimmed milk, then in clear water, with blue starch, smalt, and gum; this process takes a month in summer, and six weeks in winter.

Q. From what country is flax supposed to have been brought?

A. From those parts of Egypt frequently inundated by the Nile.

HEMP.

Q. Is not the preparation of hemp very similar to that of flax?

A. Yes; but the fibres of this plant are coarse, and, from their toughness, very useful for any thing requiring great

strength. After being gathered and steeped like flax to separate the fibres, it is carded and prepared for spinning.

Q. In what country is hemp most cultivated?

A. In Russia, whence the annual importation into England is about 100,000 tons: this will not appear surprising when it is considered that more than 180,000 lbs. of rough hemp are used in the cordage of a first-rate man-of-war.

COTTON.

Q. What preparation does cotton undergo before it is woven and spun?

A. The wool which surrounds the seeds has to be separated from them by a machine, which, at the same time loosens the fibres of the wool; it is then carded.

Q. What is the next operation?

A. It is wound upon cards in the form of cylinders worked by machinery, after which it is roved.

Q. What is roving?

A. Removing the loose fibres with an

instrument resembling a comb; it is then twisted and drawn out into threads, and sent to the weavers.

Q. Is there not a machine in which all these operations are combined?

A. Yes, it is employed for carding, roving, and spinning, and is much used in America, where it was invented.

Q. Of what are the coloured dresses worn by ladies made?

A. The greater part of them are made of cotton, on which coloured patterns have been printed or stamped. This is called calico-printing, and is a very extensive trade. Prints, muslins, chintzes, and other articles made of cotton, and sometimes linen, are printed in the same manner.

Q. What machines are used for this purpose?

A. Machines like a printing press, with blocks of wood, copper, or stone, cut in the forms of buds, flowers, or any other fancy pattern. The colours are the same as those used by dyers.

Q. Whence is the variety of patterns obtained?

A. Persons called designers are constantly employed inventing them; and should a new one prove successful, they sometimes get £150, or even more money for it.

Q. Is not dyeing also a very extensive business?

A. Yes, as silks, wools, and cotton all require dyeing or printing, to fit them for use.

Q. How are the colours on cottons and silks rendered so permanent that they so seldom wash out or fade?

A. Because every substance must be prepared, before it receives a colour, with what is called a mordant. Alum is used for linens and cottons, and solutions of metals for silk and wool.

Q. What is muslin?

A. A fine cloth made wholly of cotton, &c., of which there are numberless kinds. It was first brought from Mousol in India, whence its name. First worn in England in 1670; and manufactured there in great perfection about 1778.

Q. What is crape?

A. A kind of thin gauze made of raw silk, gummed and twisted on the mill. It was first made at Bologna.

PAPER.

Q. What is the principal use of mills?

A. That of grinding and reducing to fine particles, grain, fruit, or other substances, or for performing similar operations by means of wheels and a circular motion: thus, wind-mills and water-mills are used for grinding corn, besides which there are many others, such as powder-mills, saw-mills, sugar-mills, paper-mills, &c.

Q. Is not the process of making paper very curious?

A. Yes; paper is made of linen rags, which are first carefully picked and sorted; they are then torn to pieces by a machine which reduces them to a pulp.

Q. Describe this machine.

A. It is a revolving cylinder, furnished with sharp cutters, which is

fixed in a trough with a certain quantity of water.

Q. What is in the bottom of the trough?

A. A plate with steel bars also ground sharp. The rags are placed in the trough, and the engine being turned very quickly, they are torn to pieces, and, in four hours, are reduced to a pulp.

Q. How is this pulp cleansed?

A. The dirty water is constantly carried away, through a grating at one end of the trough, while clean water comes in at the other. The pulp then passes clean and white to another engine called the beating engine, which only differs from the other by moving more quickly.

Q. What is the next process?

A. It passes from this to a large vat furnished with a mould, the size of a sheet of paper, and the bottom of the mould is like a sieve, with brass wires, through which the water is drained.

Q. What is done with it then?

A. Each sheet of paper is placed

upon a felt, or between two pieces of woollen cloth, one upon the other, and then pressed, to squeeze the water from them.

Q. Is it again pressed?

A. Yes, but the sheets are laid one upon another without the woollen cloths, and are pressed five or six times, and then hung up to dry in rooms where there is a fresh current of air.

Q. In what state is the paper by this time?

A. Like blotting paper, and it must therefore be sized before it can be written on.

Q. Of what is size made?

A. Of vellum shavings, fish skin, gloves-leather, &c., boiled in water with white vitriol and pounded alum; after being dipped in this, the sheets of paper are pressed several times, then hung up to dry, counted into quires and reams, and are then ready for sale.

Q. Is this the only kind of paper used by other nations?

A. No, it is sometimes made of cotton and bark; straw has also been intro-

duced into this country and America, as a material. The Indians and Chinese make it of silk rags and rice.* Brown paper is made of the ends of ropes.

Q. From what is the word paper derived?

A. From an Egyptian reed called papyrus growing on the banks of the Nile, upon which the ancients wrote, and it is even now used for the same purpose.

Q. What is one great improvement of modern times in paper-making?

A. That of bleaching the rags, which enables the manufacturer to make the finest paper of almost any kind of rags.

Q. When was the first paper-mill erected in England?

A. During the reign of Elizabeth, at Dartford in Kent; but the use of paper was known in the time of Harold.

Q. Upon what did the English then write their books?

A. On parchment; the ancient Romans wrote upon the bark of the ash and lime-tree, called philyra—they called this bark, liber, which is Latin for book.

* See O'Brien's Catechism, page 51

Q. Which of our English words are derived from this?

A. Library and librarian; also the French word livre, book.

Q. What were the books among the ancients like?

A. They were rolled like maps, and placed end-ways on a shelf. We read in the Bible of "the roll of the book."

Q. Is parchment now used for writing upon?

A. Yes; in law courts, for wills or deeds; it is more durable than paper. Some of the Roman manuscripts written on philyra, have lasted a thousand years.

Q. Did the ancients write on any other substance?

A. Yes, on tablets of iron, brass, and wax; and instead of a pen they used an iron stylus, sharp at one end, to write with, and blunt and broad at the other, for the purpose of obliterating.

Q. Are pens now used by all nations for writing?

A. No; the Turks, Moors, and other eastern nations, write with reeds.

Q. What improvement has been made in pens?

A. That of manufacturing them of steel; pens so made are much more durable than those formed of quills, besides the saving of time, as steel pens require no mending.

Q. Where were they invented?

A. In Birmingham: a vast number of hands are constantly employed in making them, since each pen passes through fourteen processes before it is finished.

INK.

Q. What is required besides a pen in writing?

A. Ink; which is made of nut-galls, copperas, and gum-arabic; modern ink, however, is inferior to that of the ancients, as may be seen by the colour of the ink in some old Saxon manuscripts.

Q. What is Indian ink?

A. A preparation made by the Chinese, supposed to be made of lamp-black and glue: many persons think it is

mixed with the liquid ejected by the cuttle-fish.

Q. Did not the Romans use this latter liquid to write with?

A. Yes; and they called it—sepia.

Section 2.—Printing.

Q. What is the printing-press?

A. A machine for printing a number of words on paper quickly, instead of writing, to form books, as in ancient times.

Q. Who introduced printing into England?

A. William Caxton, a merchant, who learnt it in Germany. The first book printed in England was on the game of chess.

Q. In whose reign was this?

A. In the reign of Edward the Fourth. Printing has been much improved since that time.

Q. How many kinds of printing are there?

A. Three kinds; one for books,

another for linens and calicoes, and a third for pictures.

Q. What is meant by a type ?

A. The size or form of the letters or words ; there are large and small types.

Q. What are the names of the different types ?

A. The largest in general use for printing books, is—English ; the next Pica, Small Pica, Long Primer, Bourgeois, Brevier, and the smallest, Nonpareil and Pearl.

Q. What is printing-ink ?

A. A composition made by boiling linseed or nut oil, and burning it for half-an-hour, then mixing it with lamp-black, with an addition of soap and resin.

Q. What are the different printing presses ?

A. The printing letter-press, the copper-plate printing-press, and the steam printing-press.

Q. What is the common printing-press ?

A. A machine consisting principally of two parts, called the body and the

carriage, between which the chase containing the letters, and the paper on which they are to be printed, are pressed together.

Q. What articles are required in printing?

A. The composing-stick, the fount containing the letters, the case, the galley, and the chase, or form.

Q. Of what is the composing-stick made?

A. It is usually made of iron or wood, and is used by the compositor to arrange the letters to form one page. They are placed in the galley.

Q. What is the galley?

A. A flat wooden instrument the size of a page. When as many pages are composed as will fill a sheet or half-sheet of paper, they are put into the chase.

Q. What is the chase?

A. An iron frame, of different sizes, to contain large or small sheets.

Q. What is done to paper before it can be printed upon?

A. It is made wet. The stiffer the

paper, and the smaller the type, the wetter it must be made.

Q. How are the letters inked?

A. By a roller, filled with printing-ink, being passed over the type. The sheet of paper is then laid on a frame the exact size of the form or chase, and afterwards rolled under the bed of the press.

Q. How is the impression made?

A. By turning the screw, which causes a weight to descend; and by another turn of the hand the sheet is given up printed.

Q. What is meant by the words octavo, duodecimo, &c., &c.?

A When a sheet of paper is divided into four pages it is called folio; if into eight, quarto; into sixteen, octavo; and into twenty-four, duodecimo, &c., &c.

Q. What is meant by a stereotype?

A. When the type or letters of a book, not likely to be altered, are correctly arranged, a cast is taken of the whole and kept; so that a number of books can be printed at any time without the trouble of composing a new type. Bibles are stereotyped.

Q. To whom are we indebted for the late great improvements in the printing-press?

A. To the late Earl Stanhope: but the greatest and most wonderful invention is the steam printing-press.

Q. Is not this useful in large printing offices?

A. Yes: in consequence of the great rapidity with which so many sheets can be printed. In the *Times* Newspaper Office fourteen thousand copies of the newspaper can be printed in one hour.

Q. What is lithographic printing?

A. Printing from stone. It was brought into England in 1801. The invention is attributed to one Alois Senefelder, whose first essays were executed in 1796.

Q. What is the process?

A. A writing or drawing is made on stone, with a kind of thick oily ink or chalk; this is covered with ink of a different quality, the paper placed over it, and then pressed.

Q. What is the result?

A. The thick ink remains on the

stone, and the other is transferred to the paper, producing the required drawing.

Q. Has this method been brought to great perfection?

A. Yes; so much so that many lithographic drawings can scarcely be distinguished from copper-plate or steel engravings.

Q. How are copper or steel-plate engravings printed?

A. By a very different process. The copper or steel-plate press is formed of two rollers, one placed over the other, with only room for a board to pass tightly between them.

Q. What is next done?

A. The steel or copper-plate upon which the drawing is indented is slightly heated to liquefy the ink, the paper is spread upon it, and then covered with a soft cloth, and placed upon the board between the rollers.

Q. How is the roller turned which presses them together?

A. By a cross lever, and the print is immediately produced.

Q. Are not calicoes and muslins printed in this manner ?

A. Yes: by the same press. Engravings on wood are printed by the letter-press.

Q. How are the drawings prepared on the wood and copper, &c., &c.?

A. They are cut or drawn with a sharp instrument: but sometimes the drawing on copper, steel, &c., is effected by aquafortis.

Q. In what manner ?

A. The metal to be drawn on is covered with wax, and the drawing is sketched upon the wax by a pointed instrument which cuts it through to the metal.

Q. What follows ?

A. The aquafortis is spread over the wax, but it only reaches the metal where the marks of the drawings are made, and it corrodes or eats into it exactly in the form of the engraving intended.

Section 3.—Cutlery, Glass, and other Manufactures.

Q. Is not machinery much employed in the manufacture of articles of cutlery?

A. It is.

Q. What is comprised under the term cutlery?

A. All cutting instruments made of steel.

Q. How are table knives and forks made?

A. Table knives are usually made of shear steel. After being forged, they are hardened by being beaten when red hot, and then plunged into water; the next operation is that of heating them again over the fire till they become blue; they are then ground upon stones of large diameter. Forks are made almost altogether by the aid of the stamp and appropriate dies: the prongs only are hardened and tempered; the shanks and bosom of the fork are ground upon a thin stone.

Q. Where are articles of the above description chiefly manufactured?

A. At Sheffield, although there are some small manufactories of them in London.

Q. What is meant by casting?

A. Casting is a term used in iron-founding, and means the running of melted iron into a mould prepared for that purpose.

Q. What are the chief objects made in this way?

A. Guns, cannons, bells, stoves, saucepans, candlesticks, brazen statues and figures, letters for printing, &c., &c.; and indeed most things made of iron, and brass, or bell-metal.

Q. What is principally understood by a foundry?

A. A place in which large furnaces are kept for smelting metals and glass; furnaces are also used by plumbers, hatters and glass painters.

Q. What is a bellows-furnace?

A. A place in which the fire is laid on a flat hearth, behind it is a large pair of bellows, by means of which the

fire is thus blown to a great heat while the metal is in it.

Q. Is not this something like a smith's forge used for making horse-shoes and nails?

A. It is; gold is melted in a bellows-furnace, silver and copper are melted in a wind-furnace.

Q. What is a wind-furnace?

A. A furnace with a hole at the bottom, through which the air passes, and has a similar effect to a pair of bellows.

Q. What is an anvil?

A. An iron block with a smooth face, on which smiths hammer the red-hot metal and shape it.

Q. What are the workmen generally called who work metals?

A. Smiths; as goldsmiths, silversmiths, coppersmiths; and those who prepare steel articles for cutting, such as knives and scissors, are called cutlers.

Q. Why is steel used for these articles?

A. Because on account of its hardness it can receive a very sharp edge.

Q. How many hands do scissors,

snuffers, &c., pass through before they are finished?

A. Nearly twenty, while the different manipulations they undergo cannot be less than fifty or sixty.

Q. What other useful steel article passes through many hands?

A. A needle: this very useful little instrument is said to have been first made in England by a native of India, in 1545; but the art was lost at his death: it was afterwards recovered by Christopher Greening in 1560, the manufacture being carried on up to a very late period at Long Crendon, in Bucks.

Q. When were knives first made in England?

A. In 1563, during the reign of Queen Elizabeth. Forks were not introduced until the reign of James the First, and it was even then considered affectation to use them instead of the fingers?

Q. How are modern forks made?

A. They are made upon an anvil, and the prongs are stamped and ground upon a dry stone.

Q. How many hands does a table-knife pass through?

A. Sixteen; and undergoes one hundred and forty-four operations before it can be used.

Q. Is it soon made?

A. Yes; by the help of machinery, a dinner-knife at Sheffield is shaped in a few minutes.

Q. Of what are pins made?

A. Of brass wire tinned. When the pins are formed they are placed in a vessel between tin plates; it is then filled with water and tartaric acid, by means of which the tin is dissolved, and after a five or six hours' boiling the pins are found tinned.

Q. What causes the tin to unite with the brass?

A. The zinc, of which brass is partly formed.

Q. How are pins polished?

A. They are thrown into a tub containing bran, and a wheel or shaft in the centre turning them round quickly, they are soon rubbed bright.

Q. How is glass made?

A. It undergoes many operations, and the ingredients of which it is composed are soda, or kali, and flint.

Q. What is said to have been the origin of the invention of glass?

A. That some sailors cast on an island having made a fire of the herb called kali, found, that when burnt, it mixed with the flint stones on the shore and formed a kind of crystal. Man's ingenuity acting upon this suggestion at length produced glass.

Q. What is the first operation in making glass?

A. Melting the flint in a furnace; it is then called frit. To make it clear and white for window-glass or other things, it is again melted or boiled with manganese.

Q. What is the next operation?

A. It is then blown to make round glass, as phials and drinking glasses, or cast in moulds for plate glass.

Q. How is glass blown?

A. By blowing through a pipe, some-

thing in the manner of making bladders with soap and water; the glass being hot can be formed into any shape while blowing. It is now generally done by a chemical preparation, which produces great heat, through a pipe, and the glass is worked while melting.

Q. When were drinking glasses first used?

A. In the reign of Queen Mary; they were at first considered more precious than silver.

Q. How are looking-glasses made?

A. With plate-glass highly polished, and covered at the back with mercury or quicksilver.

Q. How is coloured glass produced?

A. By painting on the glass and then baking it in a furnace.

Q. When were looking-glasses first used in England? *

A. In Queen Mary's time, but they were very little used, and were so small that ladies carried them in their pockets or at their girdles.

* See "Erredge's Student's Handbook of General Information," page 12.

Q. Where were the first glass windows seen in England?

A. At Hesham Abbey, in Northumberland. They were made by some French workmen; the Italians first used glass for windows.

Q. Which are the chief manufacturing towns in England for glass?

A. Newcastle and Worcester.

EARTHENWARE AND CHINA.

Q. What are potteries?

A. Places in which earthenware is made; the best ware is from China, and is called porcelain.

Q. What are the instruments used in pottery?

A. The wheel and lathe; clay and flint are the chief ingredients.

Q. How are cups, basins, and jugs, or other round utensils made?

A. The flint is ground to a powder, and then melted with the clay till it becomes like thick paste; it is then turned round quickly by a wheel, and the potter forms it into any shape he pleases.

Q. How are flat or other shaped vessels made?

A. In moulds of gypsum; the clay articles are then baked for sixty hours in a kiln; in this state it is called biscuit.

Q. Is not the manufacture of porcelain very similar?

A. Yes; but while in a state of biscuit it is painted blue with cobalt, and then dipped into a glazing made of lead and glass, with other ingredients, and again baked for forty-eight hours.

Q. Will it now receive other colours?

A. Yes; and any gilding the pattern may require; it is then baked again for ten hours, and the gilding burnished with bloodstone or agate.

Q. Does the baking change the colours?

A. Yes; they are very dull and quite different before baking.

Q. What is the origin of the word *porcelain?*

A. It is said to be a corruption of the phrase *pour cent années*, it being believed that the materials of porcelain were matured under ground 100 years.

Q. Is not China-ware brought to great perfection in England?

A. Yes; for that manufactured in Chelsea, and in the counties of Derby and Worcester, surpasses most other china in beauty and elegance.

Q. From what is the purple colour produced on porcelain?

A. From gold; the yellow from silver, and the bronze from the oxide of iron.

TURNING.

Q. What is turning?

A. The art of forming solid substances, such as wood, ivory, &c., into spherical and various other shapes by means of a lathe.

Q. What kind of instrument is the lathe?

A. One upon which the substance is kept turning round like a wheel on its axis, and a chisel, or sharp tool, by which the outside is cut off as it turns.

Q. Is turning supposed to be very ancient?

A. Yes; it is said by Pliny and

other ancient writers, that the beautiful vases, with their figures and ornaments, were produced in this manner.

HATS.

Q. How are hats made ?

A. By preparing the skins of various animals, but principally the beaver. The skin of this animal is covered with two kinds of hair, the one long, stiff, and glossy, the other short, thick, and soft.

Q. Which hair is used for hats?

A. The short hair ; it is scraped off and carded like wool, then beaten, pressed, and entangled together to form a kind of cloth called felt. It goes through several processes, and is then blocked.

Q. What is the next operation?

A. It is sent to the dyer, whose copper is so large that it will hold twelve dozen hats ; these are boiled in the dye ten or twelve times successively for three quarters of an hour each time ; between each boiling they are allowed to cool.

Q. Of what is the dye made ?

A. Of logwood, verdigris, copperas, and some other things. After this the hats are returned to the hatter, who dries and stiffens them with glue or gum seneca: lastly, they are steamed on an iron plate, dried, and then ironed.

Q. Who introduced hats into Europe?

A. Charles the Seventh of France, in 1499. Beaver for hats is now almost superseded by silk.

SUGAR.

Q. What preparation does the sugar-cane require?

A. It is gathered and carried to the mill, where it is pressed between two iron cylinders; the juice is received into a trough, and from thence conveyed to a boiler.

Q. What is thrown into the boiler?

A. Quicklime, which causes the oil and acid to rise to the top with it; both of which are then skimmed off.

Q. What is done when the sugar boils?

A. It is strained through into another boiler, where it undergoes the same process ; this is repeated six or seven times ; it is then received into shallow wooden vessels called coolers.

Q. What change now takes place in the sugar ?

A. It separates into grains, leaving the molasses or treacle ; when dry it is called raw or moist sugar.

Q. How is it refined and made into white or loaf sugar ?

A. Formerly it was effected by boiling the sugar with bullocks' blood and other albuminous substances, but lime, and burnt alumina, are now more frequently employed. After this process it is poured into a mould in the form of a cone, and called a sugar loaf.

LEATHER.

Q. How is leather made?

A. By preparing the skins of animals. The unprepared skin is called a hide.

Q. What is the first operation it undergoes?

A. Soaking in lime-water to cleanse it from grease and other impurities; the hairs are then scraped off with a kind of knife, and the oil and grease more completely removed by alkali or a solution of sulphur.

Q. What is done next?

A. It is taken to the tan-yard, stretched over a pit, and covered with tan for two months.

Q. What is tan?

A. The bark of the oak, chopped and ground by a tanning mill to a coarse powder.

Q. Are all skins tanned in this manner?

A. No; if they are intended for the upper parts of shoes, seats of saddles, or any purpose not requiring it to be very strong or waterproof, they are first sent to the currier.

Q. What is the currier's part?

A. His work is to scrape it, and reduce it to the same degree of thickness all over, and also to render it soft and flexible by oil or grease; it is then tanned.

Q. What is the last process?

A. The skins are hung up to dry in the air, the tan is then cleaned off, and they are stretched upon one another to keep them tight and straight.

GOLD WORKING.

Q. Is not gold manipulated in order to produce gold wire and gold leaf?

A. Yes; gold wire is formed by drawing a piece of silver covered with gold, about the size of a tobacco-pipe, through a number of holes, the last always smaller than the one before it, until it is as fine as the hair of the head.

Q. What is leaf-gold?

A. Gold beaten with a hammer on a block of marble; it is said that an ounce of gold may be beaten into sixteen hundred leaves, each three inches square.

Q. What is gold thread?

A. Flattened gold wire twisted or spun with a wheel round threads of silk or iron bobbins.

Q. What is shell-gold?

A. It is made of the parings of leaf-

gold, ground into powder on a marble, and with honey. After having been for some time infused in aqua-fortis, it is put into shells, to which it sticks.

Q. For what is leaf-gold useful?

A. For gilding picture and looking-glass frames, leaves of books, and other ornamented goods.

Q. What is sometimes used with gold for gilding?

A. Vellum, and leaves made of the entrails of an ox: the gold is interlaid with these substances, covered with parchment, and beaten to their size; and it can then be laid on the article to be gilded.

Q. What is gold-beaters' skin?

A. A skin for healing wounds, prepared in the same manner.

Q. Is gold ever applied in a liquid state for gilding?

A. Yes; quicksilver dissolves gold and unites with it. Buttons are gilded with liquid gold; they are dipped in, and then exposed to a great heat, by which the quicksilver is evaporated, and the gold left upon the buttons.

Section 4.—Brewing, Distilling, etc.

Q. How are beer, wine, and spirits made?

A. By brewing and distilling.

Q. What is brewing?

A. The operation of preparing ale or beer from malt and hops.

Q. What is malt?

A. It is made from barley steeped in water for two or three days; the water is then drained off, and the grain becomes heated, swells, bursts, turns sweet, and ferments.

Q. What is fermentation?

A. Fermentation is a kind of change or decomposition which all vegetables undergo, either while vegetating underground, or in a state of decay.

Q. Does not this cause the malt to sprout?

A. Yes; but this is stopped by putting the malt into a kiln, where it is dried by a gentle heat, and is then fit for mixing with hops to make beer.

Q. What is this first fermentation called?

A. Saccharine, from its sweetness.

Q. What is the first process in brewing called?

A. Mashing. The malt is steeped in warm water in a mashing-tub; after water has been added two or three times, the water is drawn off, and is called wort.

Q. Is not this done twice?

A. Yes; and the wort is again drawn off; the first is called sweet wort, from the sweetness of the malt.

Q. What is the next process?

A. The two worts are mixed, the proper quantity of hops added, and the whole closely covered and gently boiled for an hour or two; it is then strained from the hops into coolers.

Q. How is it fermented?

A. When cool some yeast is added, and it is left to ferment for a certain time.

Q. What is yeast?

A. A kind of thick froth produced by the fermentation of malt; by fermentation the liquor is preserved from turning sour. Yeast is used in making bread.

Q. How many kinds of fermentation do vegetables undergo?

A. Three: the first sweet, the second vinous or acid, the third putrid; therefore all fermented liquors must only ferment for a certain time, otherwise they will become decomposed.

WINE.

Q. How is wine made?

A. By pressing the juice from grapes in a machine called a wine-press. In countries famous for wines grapes are cultivated in vineyards, and the time of gathering them is called the vintage.

Q. What are the processes of making white and red wines?

A. The grapes for red wines are trodden, or squeezed with the hands before they are pressed; for white wine the grapes are put into the wine-press immediately.

Q. Is not the difference caused by the red and white grape?

A. No; as sometimes the skins of the purple grapes are taken off, and the inside only used for wine.

Q. What is the process after the juice has been pressed from the grape ?

A. It is put into large tuns or barrels to be fermented ; this is done with sugar.

Q. What is this fermentation called?

A. It is the second fermentation which vegetables undergo, and is called the vinous.

Q. What is the juice called before it is fermented ?

A. It is called the must, and the sediment at the bottom of the vessels in which it is contained is called the lees.

Q. Are the lees of wine useful ?

A. Yes ; a kind of potash or kali made by burning the lees of wine is very useful to dyers, and as a medicine for some diseases.

Q. What countries are famous for wine ?

A. France, Spain, Portugal, and the Madeira Islands : Hungary and Germany also produce some good wines.

Q. Which are the principal French wines ?

A. Champagne, Vin de Grave, Pon-

tac, Frontignac, Muscadel, Burgundy, Claret, and Hermitage.

Q. Are there not two sorts of Champagne?

A. Yes; still Champagne and sparkling Champagne. The difference is caused by the sparkling Champagne being bottled before fermentation has ceased.

Q. From what did this wine take its name?

A. From the province of Champagne, where the grapes are grown from which it is made.

Q. What are Frontignac and Muscadel?

A. White wines produced from the province of Languedoc. Muscadel is supposed to have its name from *musca*, a fly, because the fly is so fond of the grape of which it is made.

Q. What are Burgundy, Claret, and Hermitage?

A. Red wines. Burgundy takes its name from the province of Burgundy, Claret comes from the country near

Bordeaux, and Hermitage from the banks of the Rhone.

Q. What are the wines most used in England?

A. Port and Sherry. Port is a red wine; it comes from Oporto, in Portugal. Sherry is a strong white wine brought from Xeres, near Seville, in Spain.

Q. What are the other Portuguese wines?

A. Lisbon, and white Port.

Q. What is the wine brought from Madeira, one of the Canary islands?

A. It is called Madeira, and is the most valuable of white wines. Malmsey Madeira used to be called Canary sack.

Q. Which are the Spanish wines?

A. Mountain, or Malaga, Tent Wine, and Sherry. Tent Wine is so called because it is white wine tinted or coloured to produce a red wine. It is produced in Alicant.

Q. Which are the German wines?

A. Tokay, Hock, Rhenish, and Moselle. The grapes from which Tokay wine is made are so sweet that the

hill on which they grow is called Sugar Hill.

Q. Are not some wines quite white, like water?

A. Yes, Hock and one or two other very expensive wines, not much used in England.

Q. What is cider?

A. The juice of apples fermented; perry is the juice of pears. These are both very pleasant, cooling liquors, and made in a similar manner to wine.

DISTILLING.

Q. What is meant by distilling?

A. It is the art of separating spirit or essential oils from liquor, by heat or evaporation.

Q. How is brandy distilled?

A. Fire is placed under a closed vessel, called a still, containing some weak French wines; the spirit rises in steam, which not being allowed to escape, recondenses in fluid.

Q. Whence have we the finest brandy?

A. From Bordeaux, Languedoc, and Anjou. Cognac brandy comes from Anjou.

Q. Is brandy white when it comes from the still?

A. Yes, white as water; it is coloured by burnt sugar and other simple things. French brandy is paler than English.

Q. With what is Hollands or Geneva made?

A. With juniper berries. English gin is distilled from malt, flavoured with oil of turpentine, a few juniper berries, and hops.

Q. What is whisky?

A. A liquor distilled from barley; it has a smoky flavour from the peat with which the still is heated.

Q. What cordials are made from brandy?

A. Noyau, ratafia, and cherry brandy.

Q. How is Noyau made?

A. By mixing white brandy, sweet and bitter almonds, and other kernels. Ratafia is made by infusing the kernels

of cherries, apricots, and other fruit in brandy, and adding sugar, cinnamon, cloves, &c.

Q. What is cherry brandy?

A. Cherries boiled with brandy; the juice mixing with the brandy takes away its strength. The cherries are put in whole.

CHAPTER VIII.

MATHEMATICS.

Section 1.

Q. How are mathematics divided?

A. Into pure, mixed, speculative, and practical.

Q. What are comprehended under pure mathematics?

A. Arithmetic, algebra, and geometry.

Q. What are mixed mathematics?

A. Astronomy, geography, and physics. Speculative mathematics consider magnitude abstractedly.

Q. What is meant by practical mathematics?

A. Practical mathematics can be applied to the uses of life, as in mechanics.

Q. What are the uses of arithmetic and geometry?

A. Arithmetic treats of number, and geometry, of magnitude.

Q. What are the names given to geometrical figures?

A. Superficies and solids. Superficies consist of triangles and figures, with three, four, five, &c. sides.

Q. What are these figures called?

A. A figure of three sides is a triangle; a figure of four sides a quadrangle, a square, or a parallelogram.

Q. What are the others?

A. A figure of five sides a pentagon, of six sides, a hexagon, of seven a heptagon, of eight an octagon, of nine a nonagon, of ten a decagon, and of many sides a polygon.

Q. What is an angle?

A. The inclination or opening of

two lines, having different directions, and meeting in a point.

Q. How many kinds of angles are there?

A. Three, the right, the acute, and the obtuse.

Q. What is a right angle?

A. One in which the lines are perpendicular to each other, and contain 90°.

Q. What is an acute angle?

A. One less than a right angle.

Q. What is an obtuse angle?

A. One greater than a right angle.

Q. What is a triangle?

A. A geometrical figure containing three sides and three angles.

Q. Are triangles useful?

A. Yes; for by means of them, as taught in an art called trigonometry, most problems in astronomy, geography, navigation, and surveying, are performed.

Q. What is included in mixed mathematics besides astronomy and eography?

A. Mechanics, physics, pneumatics,

hydraulics, hydrostatics, perspective, navigation, gnomonics, pyrotechnics, military and civil architecture, with optics and acoustics.

Section 2.—*Mechanics.*

Q. What is the most useful division of mathematics ?

A. Practical ; as under that we have mechanics and the wonderful uses of mechanism in machinery or works of art.

Q. What are the principal mechanical powers ?

A. The lever, the wheel and axis, the inclined plane, the pulley, the wedge, and the screw.

Q. Of what use is the lever ?

A. It is the foundation of all the mechanical powers. The use of the lever may be shown by placing a large heavy stone on the ground, and a smaller one in front of it ; then by pushing a walking-stick under the large stone, and balancing it on the small one, the

large stone will instantly be lifted with ease.

Q. Which is the lever in this example?

A. The walking-stick is the lever, the small stone the fulcrum, the heavy stone the weight, and the hand the power or force used.

Q. What is the wheel and axis?

A. It is simply a wheel turning on an axis like a carriage-wheel; the great power of a wheel consists in its large size in proportion to its axis. Wind and water mills are made on this principle.

Q. What is a cogged wheel?

A. A large wheel with notches or teeth moving another wheel (also with teeth) the contrary way; they are used to increase or lessen the motion.

Q. Are not clocks and watches made on this principle?

A. Yes; and the ticking of a clock or watch is caused by the movement of these cogged wheels, which move a notch at a time.

Q. How are clocks and watches put in motion?

A. Clocks are put in motion by a weight which turns a cylinder, and this sets all the wheels going.

Q. Are there many wheels?

A. Yes; of different sizes; also numbers of teeth to indicate seconds, minutes, hours, and even days and months.

Q. How are watches set in motion?

A By a coiled spring, which, in trying to unwind itself, sets one wheel in motion, and this turns all the others.

Q. What is a pulley?

A. A kind of small wheel, over which a string is passed, with a weight fastened to the end; this is called a moveable pulley, and is used to draw a great weight quickly from the ground.

Q. What are fixed pulleys?

A. They are used to balance weights, as in the window-sash or window-blind.

Q. What is the inclined plane?

A. A sloping surface used to transfer heavy weights from one level to a higher one. Something of this kind is used by bricklayers for wheeling heavy wheelbarrows.

Q. Of what use is the wedge?

A. The wedge is used to split rocks, trees, &c.; it is a thick piece of wood in the form of a triangle.

Q. What is the screw?

A. A spiral groove or thread winding round a cylinder, and when turned with a lever is of great force for moving weights or pressing bodies close together.

Q. Does every machine require all the mechanical powers?

A. No; mills, clocks, and watches, require only the wheel and the axis. The simple printing-press is formed with the screw, the lever, and the wheel.

Q. What is the mechanical power employed in a common pump?

A. The lever, which is formed by the handle. A pump requires also valves, a piston, and a pipe.

Q. How is a pump made to act?

A. By raising the handle, the piston or rod, which contains a little valve or trapdoor, is pressed down through the pipe; the valve at the bottom of

the pipe is closed, and the air passes upwards.

Q. What is caused by this?

A. A vacuum, or entirely empty space, therefore, as the piston is again raised by pressing the handle, the water rushes up the empty pipe and passes through the nose of the pump.

Q. What are the principal parts of a steam-engine?

A. A large cylinder or barrel, a piston, valves, pipes, and a boiler.

Q. What is the principle upon which steam acts?

A. The boiler is filled with boiling water, from which the steam passes into the cylinder; this cylinder has a close lid or valve, which rises as the steam rushes in.

Q. What causes the lid to fall again?

A. Cold water, which is made to fall in for that purpose. The whole action of the steam-engine is caused by the rising and falling of this lid.

Q. How is this effected?

A. An upright iron rod is fixed to

the lid, and also to the end of a large beam, which, by the action of the steam and cold water on the lid, is made to move up and down with it. The action is something similar to that of a see-saw.

Q. Has not steam been substituted for cold water?

A. Yes; Mr. Watt, of Birmingham, invented a machine in which the lid of the cylinder was moved both up and down by steam alone.

Q. What difference is there between steam-engines as applied to ships or to railways?

A. When applied to ships the beam and rod of the engine work perpendicularly up and down, but when to railways, horizontally, or backward and forward; by this means the wheels are made to move round.

Q. What simple cause gave rise to the knowledge of the use of steam?

A. The inventor observed the great force of steam in lifting up the lid of a tea-kettle; and he and many others have since applied this wonderful power to the improvement of machinery.

CHAPTER IX.

OPTICS.

Q. What is meant by optics?

A. The science which considers the nature, composition, and motion of light; the doctrine of colours, and all the circumstances of vision.

Q. What is a transparent body?

A. Any body which affords a ready passage for light, as air, glass, water, &c.

Q. What are opaque bodies?

A. Those which do not allow light to pass through them, as wood, stone, &c.

Q. What is light supposed to be?

A. By some, light is regarded as a fluid or real matter, while others consider it only as a sort of undulation or vibration.

Q. Is the motion of light very rapid?

A. Yes; for it passes through a space of nearly twelve millions of miles in a minute!

Q. What is meant by refraction?

A. When rays of light pass obliquely from one transparent body to another they are bent out of their course, and are called refracted.

Q. How can this be proved?

A. By immersing a small stick in a glass of water, the end will appear bent because of the refraction.

Q. Mention another experiment?

A. Place a bowl with a shilling in it where the eye can just see the edge of the shilling; without moving the eye, pour water on the bowl, and the whole of the shilling will be seen.

Q. What is reflection?

A. When rays of light striking against a smooth surface are sent back, they are reflected, as in a looking-glass.

Q. What is the reason that in some mirrors the image is inverted, or upside down?

A. Because the surface is convex or raised, like the back of a spoon.

Q. What are lenses?

A. Convex and concave glasses used by opticians for producing certain optical effects.

Q. Are there various forms of these lenses?

A. Yes; the plano-convex lens has one side flat, the other convex; and a plano-concave is on one side flat and concave on the other.

Q. What is a double convex?

A. Convex on both sides; a double concave is concave on both sides.

Q. What is a meniscus?

A. Convex on one side, concave on the other. Burning glasses are double convex. Furniture has been scorched by exposing a decanter of water, which is a double convex, to the rays of the sun.

Q. Is not the eye convex?

A. Yes; the images of objects are reflected through a kind of horny coat, called the cornea, and painted on the retina at the back of the eye; the cornea being convex, objects are inverted, but to the mind they appear erect.

Q. What is one reason for the dimness of sight in old persons?

A. The convex part of the eye becomes flattened, and the rays of light do not unite clearly on the retina.

Q. How are colours in objects produced?

A. By the property possessed by bodies of separating the elementary rays of light, and absorbing some and reflecting others.

Q. Of what use are the concave and convex lenses?

A. They are very useful for spectacles, microscopes, telescopes, magic-lanterns, &c. &c.

Q. What is the usual form of glasses for spectacles?

A. Convex, as the eye having become flattened by age, the convex lens is of use to unite the rays of light.

Q. What is the cause of young persons sometimes wearing spectacles?

A. From the eye being too convex —this is called near or short sighted. The lenses of these glasses are concave, to spread the rays and render the sight clear.

Q. What are the lenses used in microscope?

A. As the object can be brought near the eye, the single microscope has

but one convex lens, but a compound microscope has many, and some of them enable the eye to enlarge the object, at six inches distance, three hundred times.

Q. What glasses are required in a telescope?

A. As it is necessary in looking at distant objects to make them appear near, a convex glass is used; but as this reverses the object to the eye, two other eye-glasses are used, which rectify this effect. Galileo's telescope had only one eye-glass.

Q. How was the telescope discovered?

A. It is said, some children of a spectacle maker in Holland were playing with some of the lenses, when they placed the flat parts of two convex glasses together, and discovered that on looking through them, a distant church appeared quite close.

Q. What followed?

A. Their father improved upon the idea, and after a few years the first telescope was made by Galileo, a native of Holland.

Q. What improved telescopes have since been constructed?

A. That of Sir W. Herschel. The tube was 39 ft. 4 in. long, and the diameter 4 ft. 10 in. It had one lens, and the object was reflected by a mirror; by it Sir W. Herschel discovered the planet now called the Georgium Sidus, Herschel, or Uranius. Lord Ross's telescope is a still more magnificent one, its tube being 56 ft. long, diameter 7 ft; and the great speculum 6 ft. diameter, $45\frac{1}{2}$ in. thick, and weighing 3 tons.

Q. What lenses are used in a magic-lantern?

A. Two, one in the fore-part of the lantern, a double convex or plano-convex, very thick and of short focus; in front of this a glass slide is placed with the picture painted upon it inverted.

Q. Why is this?

A. Because the convex lens represents everything the contrary way to which it is placed; the picture is therefore thrown on the wall upright.

Q. Where is the other lens placed?

A. At the end of a sliding tube, so that it may be shifted backwards or forwards to a proper focus.

Q. What is the focus?

A. That point in a lens at which rays of light unite, and form a clear representation of the object.

Q. What is the cause of the rainbow?

A. The refraction and reflection of the sun's rays upon the drops of falling rain: the light must be twice reflected from the drops, and once refracted or bent back, to meet the eye of the spectator.

Q. How should a person stand to see a rainbow?

A. With his back to the sun, as a rainbow must always be opposite to the sun, and can only happen while there is rain and sunshine.

Q. How is a camera obscura made?

A. By fixing a convex glass in a hole in a window-shutter; if all light is shut out, excepting that which passes through the lens, objects outside may be seen on a piece of white paper placed within the focus of the lens.

Q. Are they not inverted or turned upside down?

A. Yes; but by placing the lens in a tube inside a box, and a piece of ground glass in the lid, the objects appear in their proper position, and may be sketched and coloured from the representation on the ground glass.

CHAPTER X.

ELECTRICITY.

Q. What is Electricity or Galvanism?

A. That power by which certain bodies when heated by friction attract other bodies to them.

Q. Give me a simple experiment.

A. If a piece of glass or sealing-wax be rubbed briskly for some time with the coat sleeve, a silk handkerchief, &c., and then held near hair, feathers, bits of paper or other light bodies, they will be attracted; that is,

they will jump up, and some will even adhere to the glass or the wax.

Q. Would light be seen if this were done in the dark?

A. Yes; and this light, faint as it may be, is the electric fluid.

Q. Describe a simple electrifying machine?

A. A glass cylinder is placed on a frame, so that it can be turned rapidly round by a handle; and if, while turning, a piece or a cushion of silk be near it, streams and sparks of fire can be produced.

Q. Will all bodies convey the electric fluid from one body to another?

A. No; glass and all vitreous substances, precious stones, resins, amber, sulphur, baked wood, wax, silk, cotton, wood, hair, feathers, paper, white sugar, air, oils, metallic oxydes, all dry vegetable substances, and all hard stones, when rubbed ever so much, do not exhibit electricity, and are therefore called non-conductors.

Q. What bodies are conductors to electricity?

A. All animals, animal and vegetable substances, metals, &c., &c.

Q. By what is the electric fluid conducted to other bodies ?

A. By metallic wires. The revolving glass cylinder is placed on glass legs opposite to a metallic conductor with brass points. These points receive the electric fluid, and a person touching one of them, or the wires with which they are connected, will perceive the electric spark.

Q. What are thunder and lightning?

A. Electricity in the clouds.

Q. What is the most wonderful power of the electric fluid ?

A. Its power to contract the muscles of animals, such as man, &c., as it passes through them.

Q. How is this done ?

A. If a plate of glass, in the form of a jar, be covered on both sides with gold, silver, or tin foil, and one side be brought in contact with the brass points of the machine, the jar will instantly be charged or filled with the electric fluid.

Q. What should be done then?

A. The person who wishes to receive a shock should touch one of the brass points with one hand, and the jar with the other; he will then feel a sensation as if some one had struck him a violent blow.

Q. Is the shock always the same?

A. No; a large jar will give a much greater shock than a small one, and several jars together all charged are called a battery. Some batteries are so powerful that an ox may be killed by the shock.

Q. Who have been improvers of this science?

A. Galvani and Volta. The former from his discoveries gave the names of galvanism to electricity, and galvanic batteries to the electrical machines he invented.

Q. What is the Voltaic pile?

A. A kind of electrical machine invented by Volta, and the most perfect in acting.

Q. What is the most wonderful use to which electricity has been applied?

A. To the electric telegraph, by which in a few seconds messages and information can be transmitted many hundred miles.

Q. How is this done?

A. In the telegraph offices which are to be put in communication with each other are placed galvanic batteries, by means of which and the metallic wires the connection between the two distant stations is established, by the electric fluid passing through these wires with the rapidity of a flash of lightning. The number of wires in the chief office in London is twenty-one.

Q. In what way are these wires made to convey the messages?

A. The telegraph offices are furnished with a machine having a large dial plate (technically called a face) like that of a clock, and to which are attached one and sometimes two moveable magnetic needles or hands.

Q. What is inscribed on this face?

A. The alphabet, the letters of which are represented by the number of times each needle is made to move

or vibrate, by means of the electric fluid:

A.	being represented by	2	movements to the left.
B.	do.	3	do.
C.	do.	4	do.
D.	do.	1 to the left and 1 to the right.	

Thus every word of the transmitted message is spelt letter by letter, according to the number of times each needle moves. It should be observed, that before proceeding to transmit the message, a single movement to the left calls the attention of the clerk to the machine, and intimates that a communication is about to be made.

Q. But how can the electric fluid cause the needle to make such movements?

A. By moving a handle connected with the instrument, a current of electricity is passed through the instrument which is at the other end of the wire, thereby charging an electro-magnet, and the impulse so imparted to the hands causes them to deflect either to the right or to the left as required.

CHAPTER XI.

PHYSICS, ETC.

Q. Of what do Physics treat?

A. Of the properties of matter, and the laws of motion; or it explains the power by which we perceive solidity, softness, smoothness, quickness or slowness of motion, sour or sweet, &c., &c.

Q. What is meant by Pneumatics?

A. It is the science which treats of the various properties of air, with the clouds and vapours which float in it, called the atmosphere.

Q. What are the properties of air?

A. It is invisible, elastic, and can be compressed or exhausted by machines called Pneumatic machines.

Q. Mention some Pneumatic instruments.

A. The air-pump, the syringe, the condenser, which is a kind of syringe, the air-gun, the diving-bell, the barometer, the thermometer, and the hydrometer.

Q. What is wind?

A. Air put in motion. The power of air when compressed may be known by filling a bladder with it; and no power can press the sides together without breaking the bladder, or allowing the air to escape.

Q. What is meant by hydrostatics?

A. It is the science which teaches the nature, gravity, pressure, and motion of fluids, and the method of weighing solids in them. The mechanical practice is called hydraulics.

Q. What is the science of hydraulics?

A. It teaches how to estimate the quickness or the force of fluids when in motion.

Q. What are generally called hydraulic machines?

A. All machines worked by water. The syphon, the common pump, the steam-engine, and fountains are some of them.

Q. What is meant by Gnomonics?

A. The art of making dials, or the science of shadows.

Q. What is meant by Pyrotechnics?

A. The art of making fireworks. It is also used in reference to the structure and use of fire-arms.

CHAPTER XII.

NAVIGATION.

Q. What is Navigation?

A. The art or science by which the mariner is taught to guide his ship from one place or port to another.

Q. To whom is the invention of navigation ascribed?

A. To the Phœnicians; but until about 400 years ago no sailor would venture out of sight of land. Columbus, who discovered America, would have lost his life among the sailors on board his ship had he not discovered land when he did.

Q. How was this?

A. Because the men were much alarmed at being so long out of sight of land; they did not believe that the

world was round, and Columbus, who did believe it, expected to reach the East Indies by sailing round it westward.

Q. By what means do navigators now so easily discover their exact latitude and longitude in the open sea?

A. The latitude is discovered by taking an observation of the sun or stars. The longitude, by comparing the time so found with the time at the port or place from which the ship sailed, as shewn by a correct chronometer.

Q. How can the compass be made useful to sailors?

A. By the magnetic needle, which is placed on a little pivot in the centre of the circle; and as this needle always turns to the north, whatever direction the ship takes may be easily ascertained.

Q. What causes the needle to be magnetic?

A. It is rubbed with the loadstone, or is itself a portion of the magnetic ore; this was discovered 500 years ago

Q. Has the sailor no other guide but the loadstone?

A. Yes; by the position of the sun,

moon, planets, and stars, a skilful navigator can always discover his position on the globe, but as cloudy weather may, for a considerable time, prevent these from being seen, then the compass is a sure guide.

Q. Of what other aids do sailors avail themselves?

A. Of the Nautical Almanac, a telescope, a chart representing rocks and shoals as well as places, and a quadrant.

Q. What is a quadrant?

A. A quadrant is in reality the quarter of a circle; the quadrant for navigation is a brass instrument, numbered on the edge from one to ninety degrees, through which the altitude or height of the sun, moon, stars, &c., may be ascertained.

Q. Who was supposed by the ancients to have invented shipbuilding?

A. Dædalus; they pretend that the wings he used in order to escape from Crete were the sails of a boat; but, according to the Bible, Noah appears to have been the first shipbuilder.

Q. From whom did the Romans obtain their first knowledge of this art?

A. From the Carthaginians.

Q. Who are the greatest shipbuil ders in the present day?

A. The English, who have extensive dockyards.

Q. Where are the principal dockyards?

A. At Woolwich, Portsmouth, Chatham, Pembroke, and Plymouth.

Q. What are the different names for ships?

A. Ships are divided into ships of war and merchant ships. The frigate, or man-of-war, the ship, the brig, the sloop or cutter, and various other names. The former are generally called ships of the line, and are named according to the number of guns they carry; as a 120 guns, a 74, a 20 gun frigate, &c., or according to their tonnage.

Q. Which are the principal parts of a vessel?

A. The hull, the keel, the helm, the stern, the bow, the decks, the quar-

ter-deck, the forecastle, the masts, and the rigging.

Q. What is the hull?

A. The body of the ship. The bow is the part that goes foremost, or in front. The stern is the back or hind part of the ship, and to which the rudder is affixed.

Q. What are the parts within the hull?

A. The cabins, the steerage, the holds; and in men-of-war there are many decks, one upon another, above the hold, which is the lowest part of the ship.

Q. What is the rudder?

A. A large piece of wood on hinges, which is turned by a wheel and chains on the deck; this is called the helm; by this the ship is guided.

Q. What is the anchor?

A. A strong and heavy instrument of iron, consisting of a shank, having at one end a ring to which the cable is fastened, and at the other end two arms or flukes with barbs; it is dropped from a ship into the bottom of the

water, to retain her in a convenient station in a harbour, river, or a road-stead.

Q. How is the anchor drawn up again?

A. By a machine called a capstan, turned by a number of men, as it requires great strength to move it.

Q. What are the portholes?

A. Holes cut in the hull of a man-of-war, through which the mouths of cannon are placed in battle.

Q. What are the names given to masts?

A. When there are two, the one nearest the bow is called the foremast, and the other the mainmast. If three, the middle one is the mainmast, and the one near the stern the mizenmast.

Q. What are the divisions of the masts?

A. The lower mast, supported by shrouds and mainstays, the topmast above that, and the top-gallant mast still higher.

Q. How are the masts supported on the decks?

A. By the standing rigging, which consists of strong ropes, or more recently of galvanized iron wire.

Q. What else is included under the term rigging?

A. The tacks and sheets, which serve to spread the sails, the stays, the yards, the traces, the halliards, and the shrouds.

Q. What are the shrouds?

A. Ranges of ropes extending from the hull to the head of the spars or beams. They support the masts, and, being crossed by other ropes, form a ladder for the sailors to ascend and descend.

Q. What are stays?

A. Strong ropes used to support the masts in an opposite direction to the shrouds.

Q. What are the halliards?

A. Ropes or tackles by which any sail may be lowered. Sheets are also ropes used to extend the corners of sails.

Q. What are the yards?

A. Wooden bars crossing the masts where they unite with each other, and

forming a kind of platform for the seamen to stand upon when they climb the rigging.

Q. What are booms?

A. Also wooden bars to which the sails are connected, and round which they are hoisted or lowered by the halliards.

Q. What is the bowsprit?

A. A large spar extending beyond the bow of a ship. The jib-boom extends beyond that still further.

Q. What are the nautical terms for different parts of a vessel?

A. The right side is called the starboard, the left the larboard or port, and the middle between these, amidships.

Q. What is meant by windward and leeward?

A. Windward is the point in the horizon from which the wind blows, and leeward the point towards which it blows.

Q. What is meant by a ship being in the offing?

A. That it is so far at sea as to be out of anchor ground.

CHAPTER XIII.

ACOUSTICS.

Q. What is meant by Acoustics?

A. The science of sounds.

Q. What is sound?

A. Sound is supposed to be occasioned by vibrations in the air caused by the motion of the body from which the sound proceeds.

Q. How are sounds conveyed to the ear?

A. Mostly by air; but water, timber, and flannel, are good conductors of sounds. A bell rung under water has a tone as distinct as that rung in the air.

Q. How can we prove that timber conveys sound?

A. Stop one ear with the finger, and press the other close to a long stick or deal board, the ticking of a watch held at the other end will be distinctly heard.

Q. How can flannel be proved a conductor of sound?

A. Tie a poker to a piece of flannel, three feet long, press the ends of the flannel into your ears with your thumb, then swing the poker against an iron fender, you will hear a sound like a very heavy church bell.

Q. How quickly does sound fly?

A. Sound travels at the rate of about thirteen miles in a minute. This is the case with all sounds; a whisper flies as quickly as the loudest thunder.

Q. What is the principle upon which a whispering-gallery is constructed?

A. Upon the principle of reflection. Sound, like light, after having been reflected from several places, may be collected into a point from whence it will be more distinctly heard than in any other.

Q. Why can sound be reflected in a whispering-gallery?

A. Because the gallery is circular, and therefore a whisper at one side, being reflected from all sides of the

circle, is collected to the other side as a focus, and heard distinctly.

Q. Are not speaking-trumpets made on the same principle?

A. Yes; the sounds being reflected from the sides, and prevented from spreading in every direction.

Q. What is an echo?

A. An echo is sound reflected from some surface, such as a wall, a house, or a hill, which throws it back again at intervals.

Q. How far off should the surface be to reflect back a syllable?

A. About eighty or ninety feet; for a dissyllable, 170 feet.

CHAPTER XIV.

ARCHITECTURE.*

Q. What is the science of Architecture?

A. The art of erecting durable,

* See also Erredge's Student's Handbook of General Information, page 7.

commodious, healthful, and handsome buildings of all kinds.

Q. Is not architecture a very ancient science?

A. Yes; but it is not supposed to have reached any great magnificence till the time of Solomon.

Q. Whom did Solomon employ to build the temple?

A. The Tyrians, or people of Tyre, who afterwards taught their architecture to the Egyptians, from whom it passed to the Grecians, and from them to the Romans.

Q. Do all writers attribute the improvement of architecture to the Tyrians?

A. No; an ancient writer declares that Solomon received the rules of architecture from God; and that, having employed the Tyrians as workmen in gold, silver, brass, &c., he taught it to them.

Q. Is it not commonly supposed that the science came from the Greeks?

A. Yes; for there is not an order

or a moulding that has not a Greek name.

Q. But what proof have we of the magnificence of the Egyptian and Tyrian architecture?

A. The description given by Vitruvius of the Egyptian œci, pyramids, and obelisks, and from Isaiah xxiii. 8.

Q. From whom do we derive our knowledge of architecture?

A. From the Romans, whose buildings were magnificent, but who had no idea of beauty and order in them until they borrowed from the Greeks.

Q. How many orders or forms of architecture were known among the Greeks?

A. Five; the Tuscan, the Doric, the Ionic, the Composite, and the Corinthian.

Q. Of what must each order consist?

A. Of a column and entablature. The column has three parts, the base, the shaft, and the capital; and the entablature three, the architrave, the frieze, and the cornice.

Q. Where are these different parts situated?

A. The cornice is the top, the frieze the flat part under it, and the architrave the part supported by the column or pillar.

Q. What are the parts of the column?

A. The base, the part which supports it, the shaft is the column itself, and the capital the ornaments at the top of the column under the entablature.

Q. In what consists the difference of these orders?

A. In the plainness or ornament of the entablature or capital; the Tuscan and Doric are the plainest, although the column of the latter is fluted; and the Corinthian is the most ornamental.

Q. What is said to be the origin of the Corinthian capital?

A. Vitruvius relates that a Corinthian architect passed by the grave of young lady, over which her nurse had

placed a basket containing some of her playthings, and covered it up with a large tile to protect it from the weather.

Q. Upon what had the basket been placed?

A. Upon an acanthus root. As the branches sprung up they encircled the basket till they reached the tile, and then bent under it and grew downwards.

Q. In what way did the sculptor imitate this?

A. He imitated the basket in the body of his capital, the leaves in the volutes, and the tile in the abacus.

Q. What are the volutes of a column?

A. The volutes are the pointed ornaments round the capital, the abacus the top of the capital, or that part directly under the entablature. The Ionic order has four, and the Doric eight volutes.

Q. Is there any other order of architecture than the Grecian?

A. Yes, several; the ravages of the Visigoths in the fifth century destroyed the beautiful architecture of antiquity.

Q. What arose from this?

A. A new order called the Gothic, still much in use, and distinguished by its lightness and profuse ornament.

Q. How may it be known?

A. By its pointed arches, and by its pillars, carved so as to imitate several conjoined.

Q. Who introduced the Gothic order into England?

A. The Normans, in the reign of Richard I. The Saxons had also a simple style of building semicircular arches and plain massive pillars.

Q. What is the Attic order?

A. That which has a number of small pillars, with an architrave cornice for an entablature

Q. What is the Persian order?

A. It is that which has figures of Persian slaves, instead of columns, to support the entablature.

Q. Is not the Caryatic order something similar to this?

A. Yes, the entablature is supported by figures of women. New St. Pancras Church, London, is built in this style.

Q. What is the meaning of it?

A. The Greeks, having conquered the city of Caria, carried away the women captive; and, to keep up a remembrance of their being slaves, represented them in their buildings supporting the entablature as a burden.

Q. Is not architecture a proof of civilisation?

A. Yes; for in the early history of nations we find their houses built of mud or clay, and by degrees improving in form and materials.

Q. What are the common materials for houses?

A. Bricks, mortar, wood, and stone.

Q. Of what are the best bricks made?

A. Of clay, sand, and ashes; brick-making is now an extensive trade.

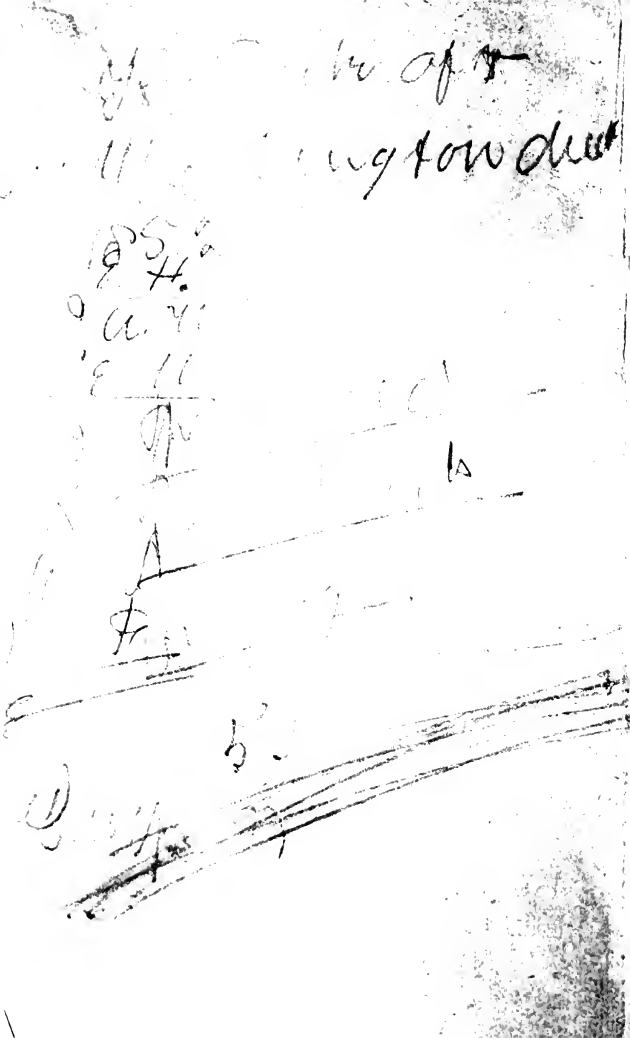
They are made in moulds four inches broad, and eight or nine long.

Q. How are they hardened?

A. By burning in a kiln, or in clumps of a number together with fire between them; they are made in this way near London.

THE END.

Spanish Inquisition
was in the



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